ATTITUDES TOWARDS EUCALYPT CLEARCUTTING AMONG AUSTRALIAN FORESTERS: A SOCIAL ECOLOGICAL ANALYSIS

A thesis submitted for the degree of Doctor of Philosophy of the Australian National University

by

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August, 1987

Statement of originality

This thesis is the original work of the author
except where otherwise indicated

K.M. Hawkins

ACKNOWLEDGEMENTS

I wish to acknowledge a number of people and organizations who helped bring this research to fruition. I am indebted to these people for their confidence in this project.

First I wish to thank Dr R.G. Florence and Mr K.W. Groves for persisting with a difficult task. I hope they enjoyed the adventure.

Second I wish to thank Dr Valerie Braithwaite for her assistance and direction in many aspects of the research.

Third I am indebted to the Institute of Foresters of Australia for the award of the Allan R. Henderson bequest, 1982, which assisted my attendance at Yale School of Forestry and Environmental Studies as part of this research.

Fourth I wish to acknowledge the grant of an International Fellowship by the American Association of University Women, 1983-84, which provided me with financial support to attend Yale University for two terms.

Finally, I wish to thank my friends and others who have given me silent support, and Helga for typing this thesis.

ABSTRACT

A social conflict has arisen in recent years in Australia between foresters and some other social groups, most notably environmentalists, about the use of clearcutting in natural eucalypt forests. A social ecological approach is used to ascertain whether there is significant variation in the attitudes of Australian foresters towards clearcutting eucalypt forests, and if so to categorise this variation.

An Australia wide survey of 1500 members of the Institute of Foresters of Australia is used to examine foresters' attitudes, while a field survey of 111 forest workers in New South Wales and Western Australia is used to examine their beliefs about clearcutting effects.

Analyses of variation in foresters' attitudes is examined using attitude scales as the dependent variables, and the independent variables of territory (State of residence), membership of conservation organizations, direct clearcutting experience, and occupational activities. Analyses suggest that foresters' attitudes vary depending on their location in a 'clearcutting' or 'non-clearcutting' State, their immediate involvement in clearcutting operations, their involvement in conservation organizations, and the nature of their occupational activities. Foresters' attitudes within these various groupings suggest adaptive social responses. Attitudes among such groups are suggested as social survival mechanisms, which are social adaptations to the social environment.

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DEFINITIONS

Attitude Scale	Content of Items
AMBIA	Effects on landscapes, recreation and wildlife
HYDROL	Effects on water quality and soil
ECOL	Effects on ecological stability
NUTRIN	Effects on nutrients
ECOEFF	Seriousness of effects on plant and animal communities and ecological stability
LANDSC	Seriousness of effects on landscapes, recreation and wildlife
HYDEFF	Seriousness of effects on water quality and soil
HYDSTR	Strategies to reduce the effects of clearcutting on water quality and hydrological properties of the forest
LNDSTR	Strategies to reduce the effects of clearcutting on landscapes
PSTSTR	Strategies to reduce the effects of clearcutting on pest and disease outbreaks
REGSTR	Strategies to reduce the effects of clearcutting on successful regeneration
WLDSTR	Strategies to reduce the effects of clearcutting on wildlife
SILSTR	Strategies and alternatives to clearcutting in eucalypt forests

PART I

CHAPTER 1

INTRODUCTION

THE PROBLEM SETTING

In 1969 the N.S.W. Forestry Commission commenced large scale clearcutting operations in the forests around Eden. This logging was of such a scale that almost immediate adverse reaction by conservation groups and some foresters followed. Clearcutting was not a new silvicultural approach in suitable forest types, and there had been little public disapproval of such operations previously.

However, changes were occurring both in forestry technology and society's awareness of the environment, which contributed to the commencement of the clearcutting operations at Eden, and the ensuing conflict between forestry interests, various groups and individuals.

Until the 1960's, most logging in Australian eucalypt forests was based on selective cutting. This tended to be expensive where the volume harvested was limited by selection techniques, and in many forest types resulted in unsatisfactory regeneration (Resource and Environment Consultancy Group, A.N.U. 1981). New harvesting and regeneration techniques were developed during the 1950's and 1960's based on the clearcutting of forests and the use of hot slash fires, seed trees, direct seeding, and planting, to overcome some of these regeneration problems (Cremer, 1960; Florence, 1964; Frankcombe, 1966).

A general environmental consciousness was also emerging about this time (Commoner, 1972). The intensification of harvesting operations in some Australian eucalypt forests, coinciding with the increasing concern of the public for environmental conservation, brought the Australian environmental movement into direct conflict with the Australian forestry profession, the forest based industries, and the State forestry authorities about the environmental effects of clearcutting operations (Leslie, 1976; Greig, 1986).

The ensuing conflict sparked much concern in Australia for the "vanishing forests" (Jones, 1976) and led to several government enquiries, including the Senate Standing Committee on Science and the Environment (1976; 1977).

Conflict between the environmental movement, private and State forestry organizations, and foresters within the profession still continues about these issues (Green, 1985; Anon, 1986, 1987a, 1987b) and is reflected in the continuing activities of the various "save the forests" groups[1].

[1]Native Forests Action Council;
Campaign to Save Native Forests;
Wilderness Society;
Australian Conservation Foundation

Conservation groups in this conflict expressed the belief that "clearfelling large tracts of forests ... would mean the destruction of these forests as we know them" (Anon, 1982). The forest based industries on the other hand, believed that "a most responsible strategy is being applied for the future welfare and expansion of our forests for multiple use management" (Ray, 1983). The forest services concerned emphasised the prospect of commercial logging of low quality forest, or forest where management could not be justified economically without large scale clearcutting (N.S.W. For. Comm., 1979).

Arguments for and against the technique of clearcutting in eucalypt forests, and discussion of environmental effects are detailed in reports of the Australian Forestry Council (1974) and the Senate Standing Committee (1976; 1977; 1978).

The current extent of research into possible consequences of forest clearcutting is reviewed by the Resource and Environment Consultancy Group (1981). Some of this research relates to (1) the adequacy of regeneration; (2) loss of possible critical soil nutrients; (3) possible site deterioration associated with slash burning; (4) wildlife habitat; (5) hydrological aspects; and (6) social and economic factors. While it is recognised there is much that is unknown about the long-term effects of clearcutting on the forest, the Resource and Environment Group concluded that operational controls are now developed to the stage where serious site deterioration is unlikely.

Concern expressed by conservation groups has not, however, been focused solely on the direct environmental effects of clearcutting. Some groups suggest that land use decisions and the attitudes of forest managers towards environmental issues are matters of greater concern than current operational standards and practices (Johnson, 1974; Scobie, 1973; Westbrook and Farhall, 1980).

The possible effects of attitudes and personal bias in formulating forest policies and practices were intimated by Routley and Routley (1975) who suggested that the attitudes of "those who control forestry planning and management" are "critical to the preservation of the natural environment in Australia", because they "usually set a low value on the natural environment and do not have a proper appreciation of the role of their forests... other than wood production".

A number of conclusions of the Senate Standing Committee (1978) suggest a divergence in attitudes to the clearcutting question existed among Australian foresters. A submission to the Inquiry by CSIRO suggests this divergence may have arisen because "industry often displays a reluctance to accept new ideas, and that it is necessary to press hard for their adoption". The committee felt "the importance of environmental protection" is not "properly understood by those whose responsibility it is to carry out the protection work in the forest". They also believed that "worthwhile and really effective environmental protection must have its origin in a recognition by senior management of its importance". These comments suggest that foresters holding different positions within forest services and the forest industry may have different perceptions of the environmental problems associated with clearcutting.

This thesis focuses on the attitudes of Australian foresters towards the clearcutting of eucalypt forest within the context of the controversy surrounding the environmental impacts of clearcutting on the native eucalypt forests.

It provides a systematic study of these attitudes, by investigating the social and environmental determinants of foresters' attitudes, using an interdisciplinary approach. Three theoretical approaches are used to explain the attitudes held by different social groups among Australian foresters; two from social psychology and one developed from a social ecological viewpoint.

The use of these theoretical approaches to attitude formation should permit greater understanding of the attitudes of foresters towards clearcutting.

RESEARCH AIMS

The aims of this study are:

(1) To document the attitudes of Australian foresters, to the practice of clearcutting eucalypt forests, and to explain variation in attitudes of different 'social groups' within the profession.

(2) To document differences in attitudes to

clearcutting arising from foresters' direct experience of clearcutting, and to examine the extent of consistency between attitudes and forestry experience.

(3) To document differences in attitudes to clearcutting arising from differences in the forestry practices adopted in the various States, and the development of 'group attitudes' among foresters within the various States.

(4) To document differences in attitudes to clearcutting according to the particular occupation of the forester within the forestry profession.

(5) To examine the potential problems arising from attitude variations within the profession, for forestry organizations, and for the development of environmentally oriented forest management practices and policies.

(6) To examine foresters' attitudes in the context of the forestry environment, and to develop an appreciation of how these attitudes develop, why they persist, and their potential effects on the practice of forestry.

ORGANIZATION OF THESIS

The thesis comprises four parts. Part I describes the background to the study and is presented in Chapters 1 and 2. Part II describes the theoretical basis to the study and comprises Chapters 3 and 4. Part III describes the research methodology (Chapter 5). Part IV gives detailed analyses and interpretation of foresters' attitudes. Chapters 6 to 10 refer specifically to foresters, and Chapter 11 gives a comparative review of forest workers and foresters. Chapter 12 attempts to integrate theoretical concepts and explain the attitude variation derived from the analyses of foresters' attitudes. Chapter 13 applies the concepts developed in Chapter 12 to organizations, and in particular forestry organizations and their interactions with the forest environment. Chapter 14 draws conclusions from the research findings. More detailed descriptions of Chapters 2 to 14 follow.

Chapter 2 presents a description of the forestry environment in Australia, and identifies the major issues bearing on the practice of clearcutting and which form the basis of this study.

Chapter 3 examines the theoretical basis to the study, focusing first on the nature of attitude and its related concepts. Three theoretical approaches to attitude formation are then developed; two from social psychology; - an individual and a social approach, and a third developed from social ecology concepts. Chapter 4 describes the limits to the study area and concludes with an overview of the research model.

Chapter 5 presents the research methodology and includes details of the survey design and survey, instrument design and questionnaire, and attitude scale development. Several techniques commonly used in the social sciences, but much less so in forestry are described in some detail. These techniques deal with the construction of attitude scales by factor analysis, and the reliability and validity testing of those scales. Details of the correlation analyses underlying these techniques are presented for the interested reader in appendices E and F.

Chapter 6 examines the effect of State of residence (territory) on foresters' attitudes. Chapter 7 examines the effect of membership of conservation organizations. Chapter 8 examines the effects of field and management experience of clearcutting and summarises the combined effects examined in chapters 6 to 8. Chapter 9 details the effect of occupational role while Chapter 10 describes the relationship between organizational involvement in policy decision-making and attitudes.

Chapter 11 describes a survey of forest workers in Western Australia and New South Wales and compares their views on clearcutting with those of foresters.

Chapter 12 provides a theoretical synthesis and possible explanation in a social and ecological extension of the framework presented in Chapters 3 and 4, for the variation in attitudes among foresters.

In Chapter 13 attitudes and organizational adaptability are examined. Attitudes and their effects on forestry organizational activities are examined. Some problems arising for resource based organizations such as forest services are elaborated.

The thesis concludes in Chapter 14 with a summary of research findings and a broader view of these research results in a social context.

CHAPTER 2

FORESTS, FORESTERS AND SOCIAL CONFLICT IN AUSTRALIAN FORESTRY

This chapter provides an account of the Australian forest resource; its variation, constraints imposed on wood production and the resulting forest practices in Australia. Australian foresters are described in the context of the organizational environment within which they work, and the professional Institute to which they may belong.

Social conflict arising from some Australian forest practices has developed both between the profession and the public, and within the profession itself. These practices relate largely, but not entirely, to large scale harvesting of eucalypt forests, generally referred to as 'clearcutting' or 'clearfelling'. This thesis is concerned with social conflict arising from the use of clearcutting as a basic silvicultural approach to the management of these forests.

THE PROFESSIONAL ENVIRONMENT OF AUSTRALIAN FORESTERS

THE FOREST ESTATE

Production Forests

There are 42.5 million hectares of commercially productive or potentially productive forest land in Australia, constituting about 5 percent of the total land area. A little under 42 million hectares of this forest is natural or native forest, details of which are shown in Table 2.1. Thirty-five million hectares of native forest are dominated by eucalypts; 98 percent of the total commercial area is made up of natural forests; the remaining 2 percent consists of plantations of softwood or broadleaved species. Plantation areas in public ownership, classified by species, are shown in Table 2.2. Private plantations account for approximately 250 thousand hectares (Bur. Agric. Econ. 1986).

No productive eucalypt forests exist in South Australia and the Northern Territory, and there is an insignificant area in the Australian Capital Territory (Table 2.1). In comparison, Tasmania, New South Wales, Victoria and Western Australia are relatively well endowed with native forests. The quality of eucalypt forest also varies, with some States better endowed than others (Table 2.1); for instance, although N.S.W. has far greater areas of production classes I and II than Tasmania, the annual yield of sawlogs and pulpwood from these forests is 2.6 million m^3, compared with the much higher yield of 3.8 million m^3 from Tasmanian forests in the same production class.

The distribution of eucalypt forests across Australia and the lack of homogeneity in the forest condition forms one basis for differences in forest practices between the States. Use of clearcutting techniques may be less appropriate on a wide scale in Queensland and most N.S.W. hardwood forests than it is in the hardwood forests of Tasmania and W.A., because of

TABLE 2.1
Native Forest Areas Classified by Forest Type
30 June 1979 ('000 Hectares)

(Source: Aust. Bur. Stats 1981)

FOREST TYPE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
Rainforest	300	-	1085	-	-	472	38	-	1895
Eucalypt									
Class I	1173	645	205	-	176	504	-	-	2703
Class II	3649	4582	1290	-	2816	1848	-	51	14236
Class III	8320	559	3300	-	19	-	-	-	12198
Tropical Eucalypt/ paperbark	-	-	4078	-	-	-	2450	-	6528
Cypress Pine	1908	-	1686	-	-	-	778	-	4372
Total	15350	5786	11644	-	3011	2824	3266	51	41932

TABLE 2.2

Plantation Areas by Public Ownership

(31 March 1979)

(Source: Aust. Bur. Stats 1981)

FOREST TYPE	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST
Coniferous	129507	82281	117483	72530	45650	31479	1213	13639	493782
Eucalyptus spp	8556	6903	1623	859	8300	554	-	-	26795
Populus spp	-	17	-	-	-	-	-	-	17
Other	-	55	472	-	-	-	-	-	527
Total	138063	89256	119578	73389	53950	32022	1313	12639	521121

differences in forest types and historical influences on the forests. A substantial area of forest in Tasmania and W.A. is still in 'old growth' condition, or only the highest quality commercial trees have been logged, leaving the forests in a poorly productive condition. A greater proportion of Queensland and N.S.W. hardwood forest has been logged more completely or periodically in the past, and many of the more accessible forests now contain a wide distribution of sizes, making selection logging an appropriate regime to maintain the limited sawlog resource in these forests. In other N.S.W. forests, such as at Eden, clearcutting techniques are more appropriate than selection techniques, though here the clearcutting may be modified by the retention of saplings, poles and early mature trees to help sustain a second sawlog harvest, and by the retention of mature or overmature trees as wildlife habitat and seed trees.

Constraints on Production

The management of the forest for wood production may be subject to a number of constraints. Firstly, as 80 percent of production forests in Australia are in public ownership (State forests and other public lands available for wood production), foresters are accountable to the public for their activities, thus placing constraints on the forest management options available to them.

Commercial forests also generally occur within the more densely populated areas around the coastal regions and in Tasmania. They are contained within a strip about 300 km wide bounded on one side by the coast, and on the other by the 500 mm isohyet (Aust. Bur. Stats 1981). Commercial forests occur throughout most of Tasmania. The location of principal commercial forest regions across Australia is shown in Figure 2.1.

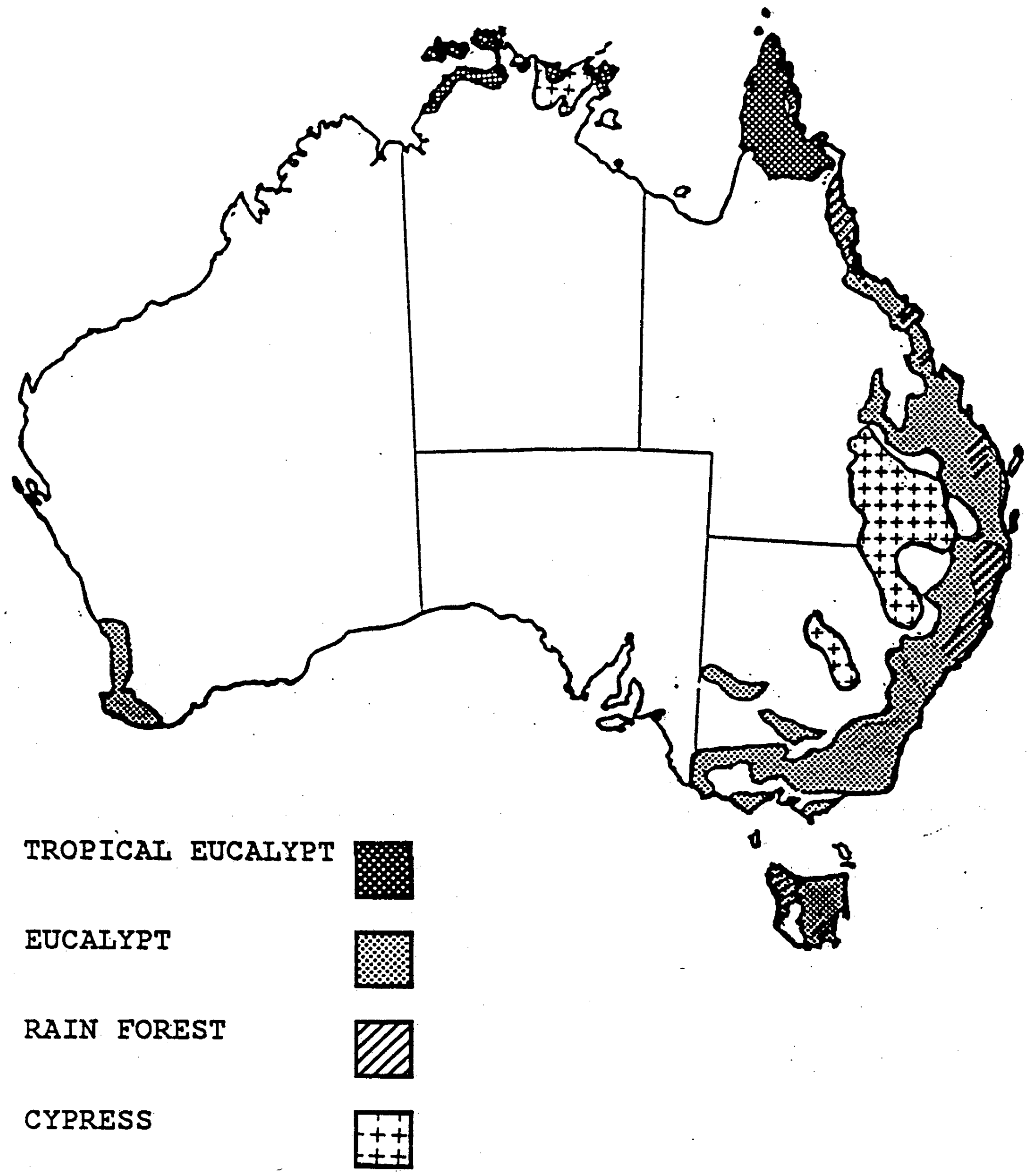

FIGURE 2.1

PRINCIPAL COMMERCIAL FOREST REGIONS

After Carron(1985a)

Because the commercial forests are relatively close to the population centres of the country, they are subject to many land use pressures. Such close proximity also makes forestry practices more visible to the public, and this in turn increases the probability of disagreement with these practices.

Within the publicly owned forests, only 60 percent is suitable for timber production, and as little as 28 percent is actually dedicated to timber production as a primary use. Thus, availability of forest for timber production is more limited than might be supposed; any removal of forest from the production category can create problems for foresters and generate discontent within the forest industry. Some examples of this are the withdrawal of logging from most of the rainforest in N.S.W., creation of a large karri National Park in W.A. and the recent additions to the national park network, and restrictions on clearcutting in Victorian wet sclerophyll forests.

Harvesting of Eucalypt Forests

While a simplification to do so silvicultural practices in eucalypt forest may be broadly categorised in terms of 'selection' and 'clearcutting' regimes. Many of the more productive eucalypt species and forest types are particularly suited to clearcutting.

These include the wet sclerophyll ash forests of the temperature region of south-east Australia (E.regnans, E.delegatensis, E.fastigata, E.obliqua), the more open E.sieberi forests of eastern Victoria and south-eastern N.S.W., and the E.diversicolor forests of W.A. The E.pilularis and E.grandis forests of the east coasts (N.S.W. and Queensland) might also be appropriately clearcut, but most of these forests have already been cutover, often on a number of occasions using a range of silvicultural techniques. There is no native forest in Queensland, most of N.S.W., the A.C.T., South Australia or the Northern Territory, occurring on a sufficient scale to justify the practice of clearcutting.

Consequently, clearcutting has been used on a substantial scale only in Tasmania, Victoria and Western Australia, and has generally been associated with integrated production of sawlogs and woodchips for export. It is used on a restricted scale in N.S.W. because of the limited area of forest suitable for large scale integrated industries, and the past history of logging and forest management.

In eucalypt forests, clearcutting is normally carried out in 'coupes' (or cutting areas) ranging from 10ha to 800ha or more. Environmental concerns were initially directed to clearcutting large continuous areas (up to 3000ha) in Eden, N.S.W. (N.S.W. For. Comm., 1979). Around 1975, the N.S.W. Forestry Commission attempted to reduce some of the environmental conflict about clearcutting operations in Eden by reducing coupe sizes initially to around 250ha, and subsequently to an average of 11ha, within a mosaic pattern of logged and unlogged areas (Humphreys, 1977).

Following a serious wildfire which burnt through a large area of regrowth, the N.S.W. Forestry Commission increased coupe size to 50-100ha in order to incorporate post-logging burning in the management regime. In other States, coupes tend to vary widely in size, 30 to 300ha being common, although they may be larger under certain conditions; for example, where there is a need for efficient fuel reduction burning, to improve regeneration, or to contain the costs of harvesting and regeneration.

Integrated sawlog-woodchip programs normally require that most standing timber be removed from the forests, although some trees may be left as seed sources, as wildlife habitat, to protect gullies and water courses from soil erosion, and for later harvest. The number of trees left standing in a coupe depends on the forest type and growing stock condition, wildlife requirements, the particular regeneration technology being used (seed trees or direct planting), the environmental problems associated with logging, and the objectives of management.

There are differences between States in the number of trees left in a coupe. New South Wales aims to retain about 25 percent tree cover where growing stock conditions permit, while in Western Australia, Tasmania and Victoria, in general, most residual standing trees will be killed in post-logging slash fires, prior to regeneration seeding - though increasingly practices are being modified to retain some component of the existing forest.

Where there is a positive policy to retain some stems at harvest, the nature of the post-logged forest may be highly variable. If the forest growing stock is particularly diverse at the time of harvest, and the forest is not subjected to an intense post-logging burn, the stand may appear to have been selectively logged rather than clearfelled. This practice is characteristic of the logging operations at Eden, N.S.W. and parts of the drier forests of eastern Tasmania.

In order to de-emphasise the effects of such cutting regimes on the forest, some State Forest Services prefer to qualify the use of the term 'clearcutting' with its implication to some people of large areas denuded of forest cover. In New South Wales, the Forestry Commission may refer to its operations as 'alternate ridge logging', 'mosaic logging' or 'alternate coupe logging'. Foresters from this State focussed on this in their questionnaires.

FOREST MANAGEMENT

National Forestry Responsibility

Under the terms of the Australian Constitution, land use (including forestry) is the responsibility of the States (Aust. Bur. Stats, 1981). In the absence of an overall National Forest policy, each State develops and pursues its own policy, although there have been attempts to develop a national approach through the Australian Forestry Council, the Forest Products Industry Advisory Council and other arms of government.

This continues to be subject to much debate at the present time (Carron, 1983).

Federal administrative responsibility is limited, the Forestry Branch of the Department of Primary Industry being responsible for policy formulation relevant to the Commonwealth Government, collating and publishing of forestry statistics, advising the Australian Forestry Council, its committees and associated bodies, and liaising with international organizations on forestry matters. It has no direct control of forests (Department of Primary Industry, 1986).

The Forestry Commodity Economics Section within the Bureau of Agricultural Economics is responsible for monitoring, interpreting, and reporting on demand, supply, and pricing in domestic and overseas markets.

Research on forestry is conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) within the Institute of Biological Resources. The Division of Forest Research (DFR) of the Institute is responsible for research in five main areas: forest ecology, biology, silviculture, tree breeding and genetics, and harvesting. The Divisions of Building Research, Chemical and Wood Technology, and Mechanical Engineering also investigate matters related to wood and wood products. The annual reports of the various divisions provide more details of these activities. Forest related research is also carried out in many academic institutions.

Australian Forest Management Organizations

Because public forest management in Australia is almost entirely the responsibility of the States, the public forests are managed by State Forest Services. Several of these have been integrated recently into broader based land management agencies, but for the most part, independent forest services control timber removals and sales from the State Forests.

The State Forest Services are, however, government bureaucracies, and as such are accountable to parliament. A number of privately owned forests (mainly softwood plantations) are managed by large timber production and/or paper manufacturing companies. These are also organizations with large numbers of staff, and foresters working in these organizations are likely to undertake the same types of activities as government foresters.

The first State to establish government control of timber production was Queensland, which established a Forestry Branch in 1900. This later became a Department of Forestry in 1958 and is responsible for the management of a wide range of forest types including eucalypt, rain forest, and softwood plantations of Pinus and Araucaria species.

The New South Wales Forestry Commission came into existence through the enactment of the Forestry Act 1916. The Commission was charged with the control of timber removals and sales of timber from the State Forests and timber reserves, the maintenance of the environment and protection of wildlife and habitats. The Commission also manages a diverse range of forests, with eucalypt forests in selection and clearcutting regimes, Pinus plantations, and some rainforest areas. As with other States, professional forestry management began with the enactment of the Forestry Act.

In Western Australia, the Forests Department operated under the Forests Act 1918 until recently (1984/85). Forest management is now part of a larger department, the Department of Conservation and Land Management. An integrated sawlog-pulpwood industry has been in existence since the mid 1970's, focusing on the more productive eucalypt forests in the karri region. Jarrah, marri and karri are the major eucalypt production species, although softwood plantations are also managed in this State. Clearcutting regimes are applied to forests in the karri region.

Forestry and forest products are particularly important in Tasmania, which has a very large forest resource relative to the size of the State. The State's Forestry Commission manages 1.6 million hectares of publicly owned forest. Private forests are also significant, and provide a large resource for sawlogs and pulplogs. Although the State Forestry Commission promotes good forest management practices for public forest, there is little control on the rate of cutting in private forests, and legislation has been needed to provide regulation of forestry practices on private land. An Act establishing some regulation of private forestry was introduced in 1985.

The Victorian Forestry Commission was responsible for forest management in Victoria, until it became integrated with a broad based land management department in 1983 (The Department of Conservation, Forests and Lands). The Department manages eucalypt forests, white cypress pine, Pinus plantations and other species. Clearcutting regimes are applied in suitable forest types.

The Australian Capital Territory has a sizeable softwood resource of Pinus plantations, and is managed by the Forests Section of the Department of Territories. This is a Federal Department, and as such, the forests of the A.C.T. are the only ones managed by a Federal Government agency. Native eucalypt forests are not managed for wood production in the A.C.T.

Forestry in South Australia is the responsibility of the Woods and Forests Department. Forest management in South Australia is concentrated on softwood plantations of Pinus species. There is very little native forest in South Australia (Table 2.1), but some broadleaved plantations have been established (Table 2.2).

Although the broad aims of good forest management and protection of the forest environment are applied by the Forest Services, the nature of the forest resource is diverse across Australia, and differences occur in the implementation of those broad aims between the States. Carron (1985a), provides a detailed history of forestry activities in Australia and the development of forest policy in Australia.

THE FORESTRY PROFESSION

Professional forestry became possible in Australia with the enactment of forestry acts in the various States. A widely perceived need for a National school of forestry lead to the establishment of an Australian Forestry School. This school commenced at Adelaide University, moving to Canberra in 1927. In 1965 the Australian Forestry School became the Department of Forestry of the Australian National University. The only other school providing professional training is at Melbourne University. Until 1982, the Victorian School of Forestry at Creswick had offered a three year diploma. Postgraduate training opportunities exist in Australia and overseas. Most foresters, however, complete their professional degrees in Australian Universities (Jennings and Bacon, 1983). Thus, there is likely to be a considerable degree of homogeneity in the educational training and background of Australian foresters.

A professional organization often follows the establishment of professional practice (Anderson et al, 1982). Such organizations set standards, membership criteria, professional ethics, rules and codes of conduct. The Institute of Foresters of Australia emerged to meet these needs in Australia, being founded in 1935.

The Institute is the forum for the forestry profession in Australia, and has a membership of nearly 1500, including most of the foresters in Australia. A profile of members of the Institute is given by Jennings and Bacon (1983). Carron (1985b) gives a detailed history of the Institute of Foresters of Australia.

SOCIAL CONFLICT IN AUSTRALIAN EUCALYPT FORESTRY

SETTING THE SCENE

Early Forestry

In Australia, as in the United States, the native forests were seen by early settlers as an unending resource to be exploited. However, by the late 1800s there was growing concern about the alienation of forest lands, and the effect of this both on wood production and the Australian environment (Barrett, 1925; Carron, 1985a).

The Forest Services were established in their modern form in most States after the first world war, and began the job of stabilising and improving the forest estate. Apart from the concern felt for timber removals and the regeneration of forests, there was little public concern about environmental matters in the early half of this century. However, by the 1960s the 'environment' had become an issue for the community at large (Commoner, 1972; Toffler, 1970). This environmental movement was universal and common to western industrialised countries, indicating growing recognition of community environmental rights, and the existence of an 'environmental crisis' (Mullins, 1976).

Conflict Emerges

As environmental awareness spread to Australia, clearcutting of eucalypt forest used for the production of export woodchips became a focus for the environmental lobby. Social concern and conflict about clearcutting began with large scale cutting of the eucalypt forests at Eden, New South Wales, in the early 1970s. It was unfortunate for the Forestry Commission at this time that circumstances forced concentration of logging into major zones, with logging of a single area up to 3000ha (N.S.W. For. Comm., 1979). This intensified the devastated appearance of the forest, and did little to convince observers that foresters were acting responsibly in these operations.

In the early stages of the Eden operations little attention was given to aesthetics, and problems arose with soil erosion and water quality (Comm. of Inq, 1974). At the time, no environmental impact statement was required; hence no special consideration was given to social values, wildlife, or the physical impact of logging on the forest environment.

Many opponents of Forest Service programmes pointed to an apparent lack of concern among foresters for the environmental consequences of these operations.

Nevertheless, many foresters would claim that they were dedicated to raising environmental standards.

The rising level of public concern led to a number of Government and Parliamentary inquiries into the environmental consequences of clearcutting. These include, for example, the Senate inquiry into the 'Environmental Impact of the Woodchip Industry Program' (1977, 1978), and the 'Investigation by the Committee of Inquiry into the National Estate' (1974). The Forwood Conference (Australian Forestry Council, 1974) and the 'Economic and Environmental Aspects of the Export Woodchip Industry' report (1975) document and explore arguments raised by foresters and environmental groups. The issues were also debated by scientists at the 47th ANZAAS congress, 'Woodchip Symposium', 1976.

The most intensive inquiry into clearcutting and woodchipping was undoubtedly that initiated by the Senate Standing Committee on Social Environment (1974). The following forest services made submissions to the Inquiry: The Forestry Commission of Tasmania (1975); the Forests Commission of Victoria (1976); the Forest Department of Western Australia (1976), and the New South Wales Forestry Commission (1976).[1]

1 This inquiry was completed by the Senate Standing Committee on Science and the Environment

This Inquiry was far reaching and extensive, and could draw on 30 formal public inquiries, both State and Commonwealth over the preceding 10 years. Although the conclusions showed forestry practices were not as devastating as many opponents claimed, still the conflict continued. The Forest Services in those States with clearcutting programs were becoming distanced from the environmental movement and in apparently opposite camps.

Individuals were also drawn into the conflict, with the 'Fight for the Forests' (Routley and Routley, 1975) containing the most notable criticism of Australian forestry. The document the 'Vanishing Forests' (Jones, 1976) also strongly attacked forestry practices. Scobie (1973), Johnson (1974) and Harwood and Kirkpatrick (1978) also presented arguments against the clearcutting programmes. Individuals and groups were concerned about the degradation of water quality, the loss of animal species and undesirable changes to the forest. Attitudes of the general public to some of these issues were sought in a number of public surveys such as those by Feller (1977) and Garton (1981).

Conflict between the forestry profession and the conservation movement indicated a number of important social problems were emerging in the relationship between the profession and the 'public'. This conflict emphasised the divergence in attitudes between the 'public' and the profession on a number of important environmental issues. Ultimately, the perception of foresters by the conservation organizations began to affect acceptance of foresters as suitable managers of the forest resource. This has led to the incorporation of the Victorian and Western Australian Forest Services into broader level management agencies and reduced the influence of foresters in forest management decisions (Greig, 1986).

A divergence in attitudes has also developed within the profession, and is shown in various papers published in professional journals criticising environmental practices and standards associated with clearcutting. A comprehensive account of the conflict and related literature is given in the report of the Resource and Environment Consultancy Group (1981).

While some foresters and many public groups expressed concern over the effects of clearcutting, forest services have generally voiced little or no concern, or defended the practice as the most suitable form of forest management for largely old growth or wet sclerophyll forests. In this way the potential for conflict of a major kind developed.

The Resource and Environment Consultancy Group (1981) comprising the academic staff of the Department of Forestry, A.N.U. who were also members of the Institute of Foresters produced a document (Environmental Effects of Clearcutting Native Forests: an Evaluation of Current Research and Research Priorities) for the Australian Environment Council. This received a cool reception from one Forest Service in particular, not because of any specific statements in the report, but rather the implication that many questions of environmental concern still remain unresolved.

The differing views within the forestry profession itself are the central concern of this thesis. The public debate on these issues has been well documented and argued; divergence in attitudes among foresters has not, however, been subject to scientific or systematic study.

THE ISSUES OF CONFLICT

This study of the attitudes of foresters is based on a set of specific issues related to the clearcutting of eucalypt forest in Australia. Six main areas of concern about the impacts of clearcutting on social, biological, and physical elements of the forest environment are given in Table 2.3. Other social concerns have also been expressed about the preservation of representative forest areas, the nature of the harvesting industry, fire management, and economic evaluation of forestry projects (Australian Conservation Foundation, 1984). Although these concerns are not directly related to the impacts of forest harvesting, they are nevertheless perceived by the public and individuals as important considerations in forestry in general.

The specific issues were identified from expression of public concern in public documents and in general research papers on the effects of clearcutting. A summary of some research studies in this respect is shown in Table 2.4. General issues of concern were identified from the submissions of the environmental groups to public enquiries and in newspaper reports.

This thesis makes no attempt to examine the scientific validity of these concerns or their remedies. Indeed, some are more related to values and aesthetics and are not empirically verifiable.

Instead, this thesis examines the attitudes of those making up the forestry profession. It seeks to identify attitudes at all levels within the forest services and forest industry, to ascertain the potential for conflict within the profession and between the profession and outside groups, and to make a statement about attitude formation processes.

In the following chapter, a theoretical framework is developed for exploring attitudes within the forestry profession, and thus potential sources of conflict within the profession.

TABLE 2.3

Social Concerns about the Clearcutting of Eucalypts

ISSUES	SPECIFIC CONCERN
HYDROLOGY - WATER CATCHMENT VALUES	Increased turbidity Soil erosion in long and short term Soil erosion on highly erodible soils Loss of topsoil Loss of nutrients Sedimentation of streams Increase in flood frequency Increase in dissolved salts Changes in ground water tables
ECOLOGICAL EFFECTS	Introduction of non-endemic species Effects of overstocking on stand dynamics Effects on ecosystem stability Loss of nutrients, especially in low fertility soils Site deterioration with slash burning Reduction in biological diversity Loss of available phosphorus Loss of plant and animal diversity Exclusion of species requiring long generations

TABLE 2.3 (continued)

ISSUES	SPECIFIC CONCERN
PEST AND DISEASE OUTBREAKS	Spread of disease from reduced habitat diversity Reduced biological and habitat diversity Weed problems arising from short rotations
LANDSCAPE VALUES	Impacts in short term Lack of planning Effects on panoramic landscapes Insufficient representative landscapes Impact of standing dead trees and logging debris Destruction of regional landscapes Reduction in visual diversity with even-aged stands
RECREATION	Reduced opportunities for recreation Reduced appeal of forests for recreation experiences Loss of wilderness
WILDLIFE	Loss of animals habitat, especially canopy dwellers Loss of species diversity Reductions in animal populations Reduction in species survival

TABLE 2.4

A selection of research studies on environmental effects associated with clearcutting of eucalypt forests

ENVIRONMENTAL CONCERN	RESEARCH STUDIES
WILDLIFE	McIlroy, 1978; Macfarlane, 1976; Heislers, 1970; Recher, Clark and Milledge, 1975.
WATER QUALITY AND FLOODING	Kriek and O'Shaughnessy, 1974.
NUTRIENT LOSS AND REPLACEMENT	Turner, Kelly and Newman, 1978; Valentine, 1976; Kelly and Turner, 1978.
ECOLOGICAL EFFECTS	Noble and Slatyer, 1977; Turner and Lambert, 1977.
RECREATION AND LANSCAPE	Greig, 1979.
SOIL EROSION AND ERODIBILITY	Langford and O'Shaughnessy, 1977; Mount, 1976; Rieger et al, 1979.
REGENERATION	Cremer, 1973; Gilbert and Cunningham, 1972; Grose, 1973.
PESTS AND DISEASE	Carne and Taylor, 1978; Carne et al, 1974.

Note: for an extensive bibliography on the effects of clearcutting see the A.N.U. Resource and Environment Consultancy report, 1981.

PART II

CHAPTER 3

SOCIAL ATTITUDES, SOCIETY AND THE ENVIRONMENT: A THEORETICAL PERSPECTIVE

In chapter 2, the nature of social conflict between the Australian forestry profession and the public was introduced, as was the need to examine attitudes within the forestry profession, as part of any study of social conflict over clearcutting.

For the present purpose, conflict is defined in terms of differences in attitudes, beliefs or opinions. Conflict can also be examined more directly by observation of actual behaviour. This may ultimately be the most appropriate arena for analyzing consensus or the lack of it within the forestry profession. However, such an approach would be costly and restrictive, would limit the range of study, and is not suited to painting the broader picture that is the goal of this research.

What is needed at this stage is a systematic study of where the forestry profession finds itself, the views of foresters from all levels within the profession, and an understanding of where differences may exist and why they occur.

Many descriptive studies of foresters and their attitudes have been undertaken (Bond and Mawson, 1968; Hendee and Harris, 1970; Kennedy and Sutton, 1978;

Bultena and Hendee, 1972). However, these studies are qualitative, and tend to use poorly defined attitudinal constructs or none at all, and unsophisticated or inadequate attitude measurement. There is little, if any, possibility of examining potential attitude variation from such studies, because they do not utilise a framework allowing generalizations or explanations of differences occurring in foresters' attitudes. These studies assume foresters are a homogeneous group with little variation in attitude.

This thesis seeks to overcome the shortcomings of such descriptive studies by examining attitudes of foresters in a systematic way and within a theoretically useful framework. The theoretical definition of attitude and related concepts provides the first stage setting for such a study.

DEFINING ATTITUDE AND RELATED CONCEPTS

EARLY DEFINITIONS

Psychologists pondering the psychological dimensions that may account for behavioural variation between people in particular situations, and consistency in reacting to different situations have lent heavily on the concept of 'attitude'.

Allport (1935) suggested that attitude was a "mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related". While this provides a description of attitude, it gives little direction as to how attitude is structured, or how it might be measured.

Attitude is generally associated with affective or evaluative responses in a way that indicates a generally favourable or unfavourable orientation to an object or event. The usefulness of attitude described in these terms has been limited, as attitudes measured as general orientations to an object do not correlate well with particular behaviours related to the object (Fishbein and Ajzen, 1975; Ajzen, 1982).

This problem of predicting behaviour from attitude led to the redefinition of attitude as a "multidimensional construct" (Rosenberg and Hovland, 1960). Attitude was described by three types of response: a cognitive, an affective and a behavioural.

This view has been supported by others, including Kretch et al (1962). It represents attitude as a 'horizontal' structure, with each component a separate part of a more complex construct, and has received much support in the literature (Kothandapini, 1971).

MULTICOMPONENT VIEWS OF ATTITUDE

While the multicomponent view of attitude is widely accepted (Ajzen and Fishbein, 1980) several theorists proposed two components to attitude, an affective and cognitive (Katz and Stotland, 1959; Bagozzi and Burnkrant, 1979) while others proposed three (Fishbein and Ajzen, 1975). The latter proposed that 'attitude' be reserved for the 'affective' component, 'belief' for the 'cognitive', and 'intention' for the 'conative'. Actual behaviour was conceptualized as a separate entity determined by 'intention'.

Each theorist, however, had a particular method for combining these components into an attitude score, which could then be used as a variable in analyses. Fishbein and Ajzen (1975) provide detailed definitions of each component, and how they could be measured, providing a methodology for assessing each of the three components as independent measures of attitude.

As there is much more support for the concept of three 'components' of attitude, than there is for any particular mathematical combination, these three attitude 'indices', the cognitive, affective and conative (Rosenberg and Hovland, 1960) are used individually in this thesis to represent the attitudes of foresters towards clearcutting. More detail is provided in Chapter 5 and Appendix E.

Having explored the nature of attitude and suggested an appropriate theoretical basis for its measurement, it is now necessary to add the next set on the stage and examine a theoretical approach to the explanation of differences that may arise in foresters' attitudes.

BASES TO ATTITUDE DIFFERENCES

Some theoretical concepts are examined that provide guidance in defining dimensions important in attitude formation, both at the individual and social level. From such concepts, specific factors associated with potential sources for attitude differences among foresters can be hypothesised and tested.

Foresters' activities involve them in interactions with social, physical and biological environments, which in turn produce changes in these environments. Thus, a theoretical perspective is required including all these dimensions as factors underlying attitude formation.

This section describes a theoretical framework developed to examine the variation in attitudes towards clearcutting among foresters. Three approaches will be examined, each of which builds on the previous one and provides a basis for exploring variation in foresters' attitudes.

INDIVIDUAL APPROACHES TO ATTITUDE FORMATION

Inconsistency between one's activities and currently held beliefs and attitudes creates a certain amount of psychological tension or 'dissonance'. This motivates most people to adjust their attitudes or behaviour so that they are consistent with each other (Festinger, 1957). Furthermore, people generally tend to avoid situations which are likely to provoke 'dissonance'.

Support for this 'Cognitive Dissonance' theory comes from a number of studies including those of Festinger and Carlsmith (1969), Keisler at al (1969) and Breer and Locke (1965).

Cognitive Dissonance theory suggests that differences in attitudes are not random, but based on differences in behavioural experiences. Attitude differences among foresters with respect to their professional 'field of interests' would thus be a function of differences in their professional activities. Thus, it might be expected that attitudes of foresters would be favourable towards forestry practices for which the forestry profession is responsible. Moreover, within the profession, more favourable attitudes might be expected among those who have experience of clearcutting operations than those who do not. Thus, foresters involved in clearcutting now or in the past might be expected to 'rationalize' their behaviour and form attitudes favourable towards clearcutting. Such rationalization would tend to reduce the potential psychological tension foresters may experience during their professional life, and although such adjustments would be beneficial to such foresters, others may see these rationalizations as irrational.

This approach can be used to examine the effect that field experience of clearcutting in eucalypt forest has on foresters' attitudes. This enables examination of one dimension underlying attitude formation, the effect of direct experience.

This approach is limited, however, as it assumes that idiosyncratic factors only are responsible for one's attitudes, and does not consider the potential effects of social and environmental factors, which could be important to attitude differences.

SOCIAL APPROACHES TO ATTITUDE FORMATION

Several theorists have attempted to overcome the limited application of attitude consistency through the reduction of dissonance, by examining the effect of social factors within a person's experience. Salancik (1982) proposed that motivation for consistency also arose through the effect of 'social logic'. Certain social situations demanded particular responses, which people reacted to in predictable ways (Abelson, 1982). In this way they were also responding to the normative pressures of the social group (Ajzen and Fishbein, 1980). These approaches emphasise the importance of the social environment in attitude formation, and suggest that characteristics of the social group can also influence attitudes.

A popular and widely documented explanation for social attitude formation is 'socialization'. This process has been used to describe differences in social attitudes between groups, and the similarity of attitudes within groups in many different situations. It can be broadly defined as "the process whereby a person acquires sensitivity to social stimuli (especially the premises and obligations of group life) and learns to get along with, and to behave like, others in his (her) group or culture" (English and English, 1958).

Previous studies on foresters, such as Kennedy and Sutton (1978), Bultena and Hendee (1972) and Duerr and Duerr (1969) focus on socialization as the basis for differences in attitudes of foresters and outsiders, or the similarity of attitudes within the forestry profession.

Explanation of attitude differences at this level of generality, however, provides little insight into the specific factors in the social environment that led to the differences. Although socialization describes what is happening within the social group, it does not say how it is happening, or provide an analytical basis for attitude differences.

There is a group of social theories that postulate specific relevant social dimensions to the process of attitude formation, and could be useful in the study of attitudes of foresters. These theories form the general framework of "interactionism" (Mead, 1967).

Interactionism in its broadest sense suggests that persons acquire the social attitudes of a group through their social participation in the common activities of the group. Participation and social interactions result in the acquisition of group attitudes through communication, imitation, and the "unintended effects" of social participation (Merton, 1936). An important concept of interactionism is that social interactions of persons in a group will affect them whether they intend to be affected or not. Thus, we might expect people who belong to a particular social group to become similar to each other in the way they behave, and in their attitudes towards issues important to the group or their activities.

Mead (1967) emphasised that it is important to share a common basis for communication, and that language is the key to social interaction and participation in common social activities. He suggests a 'group attitude' emerges among the participating members of a social group who are able to have social communications, and called this group attitude the 'social self'.

He also suggested that a different 'group attitude' arose in different social situations. Thus, where we find differences in the social situation, such as where different issues are important, or different activities engaged in, we might expect to find differences in the 'group attitudes'.

Foresters in four States are involved in clearcutting programmes in eucalypt forests (Table 3.1). Social communications or discussions among foresters in any of these States about such activities are likely to be similar because of similar administrative or implementation problems in the application of clearcutting, similar protests from opponents which may need to be answered, and similar principles and practices may be needed to reduce the impacts of clearcutting.

As Mead's proposition suggests, the social interactions of foresters within the 'clearcutting' States should produce similar group attitudes. Where there is a different social situation, then different social attitudes should prevail. Thus, foresters in the States of New South Wales, Victoria, Western Australia,

TABLE 3.1

Assignment of States to 'Clearcutting' and 'Non-clearcutting' Territories

CLEARCUTTING STATES	NON-CLEARCUTTING STATES
N.S.W.	A.C.T.
VICTORIA	S.A. + N.T.
TASMANIA	QUEENSLAND
W.A.	

and Tasmania where clearcutting is practised, might be expected to hold similar attitudes towards clearcutting, and to differ from those foresters in the other States and the A.C.T. where clearcutting is not practised in eucalypt forest. However foresters in N.S.W. may be less committed to clearcutting than the other 'clearcutting' States, because of the limited extent of clearcutting in N.S.W. compared with Tasmania, Western Australia and Victoria.

Furthermore, those foresters in States where there is public controversy about clearcutting, might be motivated to reduce inconsistencies between their attitudes and the forestry activities of their State, by developing favourable attitudes towards clearcutting. On the other hand, those foresters in States where there is no conflict about clearcutting practices, might be expected to show greater diversity of attitudes to 'clearcutting' practices, while in general, less favourably inclined to clearcutting.

Each of the previous perspectives, consistency in attitude and experience, and 'group attitudes', arising from a common source of social communication, provide testable propositions, and each may help explain variations in foresters' attitudes. However, foresters' activities occur in a range of forest environments, using a range of forestry practices, having different impacts on the forest. We would expect such differences to have some effects on attitudes towards forestry practices. Furthermore, involvement in any forestry activity varies with the forester's occupational position; for example, field foresters are involved directly with harvesting operations, while research foresters are often located in institutions having no direct involvement in commercial operations. While some research foresters will be involved in harvesting research and would thus not be totally isolated from forest operations, they are not in the 'front-line of forest activities'.

Both the individual and social approaches to attitude differences discussed previously provide some bases for examining attitude differences among foresters. However, the individually based attitude consistency and socially based 'group attitude' concepts are not sufficient to grasp the complexity of environmental factors involved in foresters' activities which could influence their attitudes.

There are several other theories not addressed previously that have something to say about common social attitudes, and to complete the range of possibilities they are noted here. Such approaches are 'community centrism' (Sherif, 1953), 'system centrism' (Katz and Kahn, 1978), 'organizational centrism' (Ducker, 1946) or reference group theory (Moore, 1973). All of these suggest similarity in the attitudes of members of social groups.

'Centrism' approaches emphasise the effects of one's social 'space' or environment on knowledge, experience, attitudes and judgements, while reference group theory suggests one's 'frame of reference' to a particular group is important to one's values (Moore, 1973).

Each of these approaches can be subsumed into an interactionist framework, however, and none adds further to an explanation of how attitudes are acquired.

An approach to attitude formation is needed that integrates the concepts of individually based 'consistency', and socially based 'group' attitudes, with the types of environmental situations which could arise within the forestry professional's activities and may affect the forester's attitudes. Such an approach would provide the broadest theoretical framework possible within current concepts of social theory.

The remainder of this chapter is thus devoted to exploring such an approach and developing an integrated framework useful for this study.

A SOCIAL ECOLOGY APPROACH TO ATTITUDE FORMATION

As social and environmental problems have emerged in response to modern resource use and development, integrated models have been needed to examine the effects of such problems on both society and the environment. This has led to the examination of society-environment relations with social and ecological models. These more closely describe the nature of social and environmental factors that could be affecting the outcomes of such relations, than do prior conceptions, which considered only economic or physical factors.

Such social ecology models have attempted to describe the types of interations between social groups and their environment that affect the way these groups use the resources of their environment, or how these groups are affected by the way they use these resources.

Such an approach has not been applied to attitudes variation, but the potential to do so is suggested by the similarity in the nature of social and environmental dimensions underlying many social ecology applications. A social ecological approach attempts to describe the complexity of society-environment relations with social and environmental dimensions common to human social systems and the ecosystems in which they exist. Thus, it ought to be possible to describe the particular social and environmental factors related to foresters and their forestry activities in eucalypt forests in terms of such common dimensions.

The social and environmental dimensions which relate to foresters and their activities are:

(1) the forestry profession itself (a social system);

(2) forestry practices (clearcutting in particular);

(3) the forest (comprising biological, social and physical resources);

(4) foresters' attitudes;

(5) foresters' participation in the conservation movement;

(6) environmental impacts of clearcutting;

(7) foresters' participation in the various forestry practices, particularly clearcutting, and their involvement in decisions about the use of clearcutting or selection logging.

Before elaborating how these relate to social ecology concepts, or on the relationships between these dimensions, it is useful to examine several applications of social ecology concepts to society-environment relations to illustrate common social and environmental dimensions applying to the present case. Two models in particular describe elements suitable for the present study.

In a study of how nutrition is affected by social and environmental factors, Jerome et al (1980) show that beliefs and values about nutrition within a culture are affected by the technologies chosen by the culture, the nature of the social organization within the culture, and the individual participants of the social organization. The holding of these beliefs and values in turn affects technology choices and the beliefs and values of the members of the social organization. The system is thus dynamic. Foresters are also members of a social organization, such as the Institute of Foresters of Australia, engage in different types of forestry 'technologies', and their beliefs are thus also likely to be affected by similar processes. The model presented in Figure 3.1 as an example, emphasises the dynamic and ecological processes that are operating within a human ecosystem.

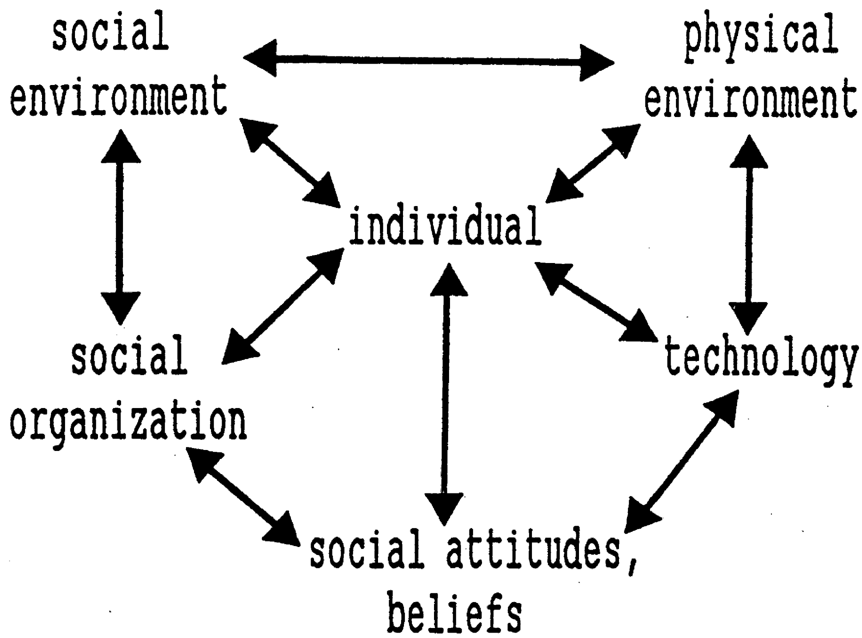

FIGURE 3.1

SIMPLIFIED NUTRITIONAL ANTHROPOLOGY MODEL

After Jerome et al (1980)

The ecological nature of the relationships between social groups, their activities and the environment, is emphasised by the various interactions that occur between these elements (Figure 3.1). Variation in these interactions would lead to variation in responses. Variation in the nature of forestry activities results in variation in impacts on social (recreation opportunities, landscapes), biological (trees and wildlife) and physical (soil and water) resources of forest. Similarly, variation in foresters' involvement with such activities would be expected to produce variation in their attitudes.

Another model (Figure 3.2) of Bennett (1976) describes other dimensions which are relevant to forestry. Here the impact of various 'technologies' on the environment, and the interactions between a social organization and these technologies that produce choices of technologies are identified. Clearcutting or selection logging represent forestry 'technologies' in this thesis, which have various impacts on the forest. Decisions to use clearcutting represent the 'interaction' of those foresters in States that choose such silviculture, with the possible choices available. Thus, involvement in the decision-making process is the 'interaction' in this case, and is in essence a social interaction process.

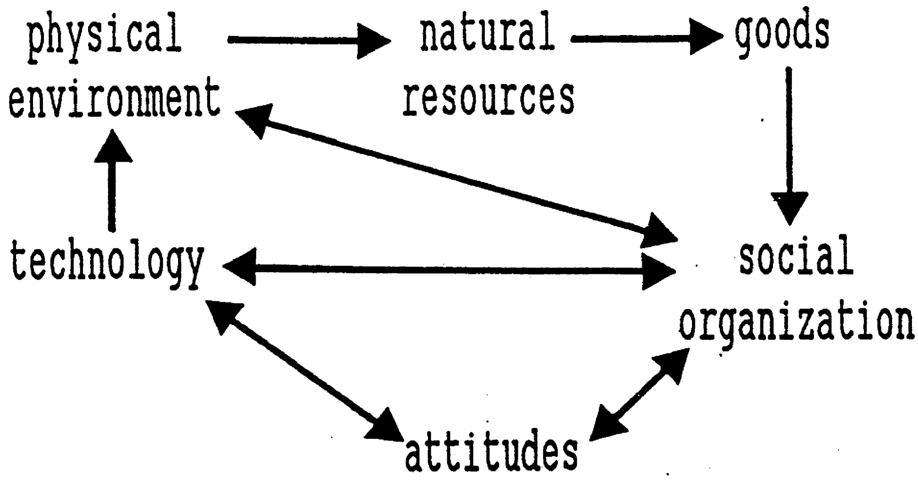

FIGURE 3.2

SIMPLIFIED CULTURAL ECOLOGY MODEL

After Bennett (1976)

These two models illustrate most of the dimensions needed to describe the forestry application in this thesis in a social ecology framework. Consideration of these dimensions and the way they are related to the forestry context, provides the basis for a theoretical framework for the study. The dimensions that correspond to the particular elements of this investigation are:

(1) a social organization (the forestry profession);

(2) a technology (silviculture of clearcutting);

(3) social, biological and physical environments (the eucalypt forest subject to clearcutting);

(4) beliefs, attitudes (foresters' attitudes towards clearcutting);

(5) interaction between a social organization or parts thereof, and technologies; i.e. foresters' involvement in decision-making processes about the silvicultural choice. Foresters have differing involvement in such decision-making depending on their occupational position in the profession;

(6) interaction between a social organization or parts thereof, and a resource environment; foresters' experience obtained through their involvement in different forestry practices. Foresters in different States have different forestry experiences depending on the silviculture used in their

State. Foresters also have different experience in forestry depending on their occupation within the profession;

(7) interaction between a technology and a resource environment; i.e. the actual forestry operations having impacts on the forest; these impacts lead to concern among the public;

(8) interactions between a social organization and social environments; foresters also have social interactions with outside organizations, such as the various conservation organizations in Australia, through their membership in such organizations.

A SOCIAL ECOLOGICAL FRAMEWORK

An integrated model for use in this study is presented here and combines the common elements of the previous social and ecological approaches and the specific forestry dimensions of this investigation. This framework should provide a better basis for analysing some causes of attitude differences among foresters, than either the individual or social approaches described, and provides a new perspective for a study of foresters' attitudes.

The elements of such a framework are outlined below and illustrated in Figure 3.3.

Social Organization

A social organization relates to a human population and describes the social units which interact within the human ecosystem. The members of the Institute of Foresters of Australia represent the population from which the social organization of this study is derived.

Two useful sub-elements of a social organization can also be defined. Each of these corresponds to a different type of social environment within which foresters have social interactions:

a. Hierarchy: the forestry profession contains members who are engaged in a wide range of occupations and forestry related activities. These occupational activities can be grouped by organizational function to represent a social 'hierarchy' within the profession. Such a hierarchy exists in terms of differences in the responsibility of each function for decision-making or forest management activities. Thus, hierarchy defines the social organization of foresters in terms of occupational activities.

(b) Territory: the geographic or physical location in which foresters' professional activities take place represents their 'territory'. These are the various States of Australia, which are also grouped as 'clearcutting' and 'non-clearcutting' (Table 3.1).

Foresters belong within a particular territory because of their physical location within one of the States. Location within a State is linked with indirect or less direct experience of forestry practices, as opposed to direct experience obtained from participation in forestry operations.

Social Responses

Social responses refer to the attitudes, values, beliefs and opinions of a social group. The focus is not on the attitudes of individual foresters, which may arise as a result of personality or idiosyncratic experience, but rather on the attitudes of a specific social group. A social group for the purpose of this thesis is defined as those foresters who participate, or have the opportunity to participate, in the activities of the group. Participation may be direct as in field operations, or indirect through employment in a particular State.

Resource Environment

The forest comprises three resource types, biological (trees and wildlife) physical (soil and water) and social (recreation opportunities and landscapes). Each of these will be affected by forestry activities to differing degrees depending on the nature of the forest, the technologies utilised, and preventative and rehabilitative measures applied.

Effects on Environment

Forestry practices have important effects on the forest environment; some may improve the forest, others may degrade it. Those effects of forestry clearcutting operations that have potential adverse environmental effects on the forest environment, its biological, physical and social resources, are important in this study as the focus for foresters' attitudes towards clearcutting.

Technology

Different silvicultural choices correspond to different types of forestry technologies. The term technology in this thesis refers to the particular silviculture applied to the forest.[1]

Other Social Arenas

Foresters also have direct contacts with non-foresters who are members of various conservation organizations in Australia. These other conservation organizations represent 'other social arenas' within which foresters have social interactions.

Interactions between a social organization and a resource environment

Interactions between foresters and the forest will vary, depending on the States they reside in, the

[1] A technology represents a broad policy level activity, and may in practice be applied differently. For instance, clearcutting coupe sizes vary between those States which use this practice, as does the layout or design of coupes within the forest.

silviculture they are involved with and their occupational position. Foresters' experience in forestry practices will vary depending on their participation in forestry operations in the various States. These interactions are thus variations in the experience of foresters in forestry practices.

Interactions between a social organization and other social environments

Social interaction between foresters and the conservation movement results from membership of the various conservation organizations in Australia. Such membership corresponds to the interaction of foresters with 'other social arenas' in this framework.

Interactions between a social organization and technology decision-making

The position of foresters in a hierarchy of access to policy decision-making results in differences in their interactions in the formulation of policies and the choice of technologies. The organizational function of foresters' activities will affect their position in such a hierarchy.

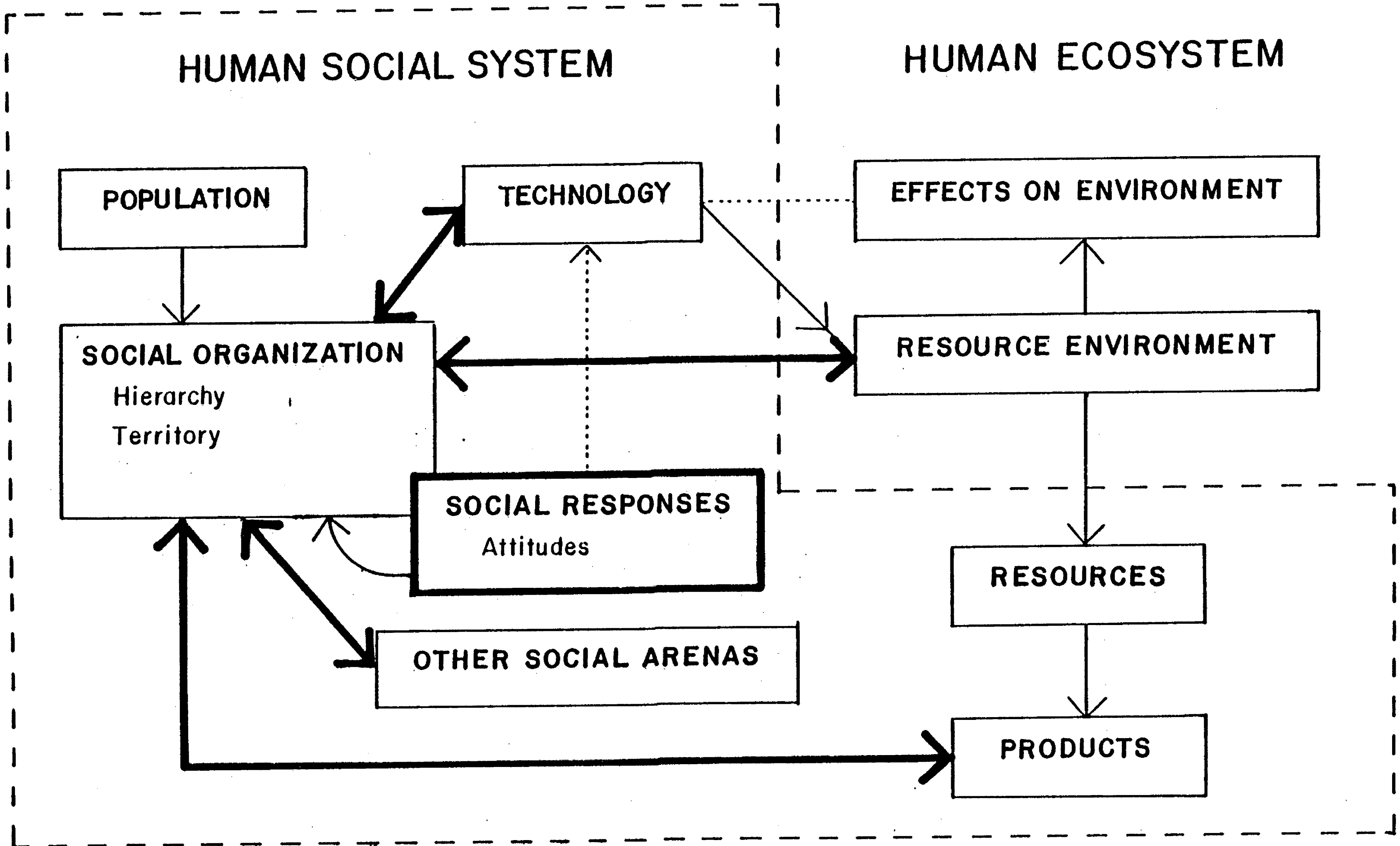

FIGURE 3.3

A SOCIAL ECOLOGY PERSPECTIVE FOR ATTITUDE FORMATION

SUMMARY

The model (Figure 3.3) proposes that the attitudes of foresters (social responses) towards the clearcutting of eucalypt forests (a technology) result from the effects of interactions of the social organisation of the profession with (a) the forest environment (via technologies applied); (b) other social groups, such as those in the conservation movement; and (c) involvement in decision-making about forestry technologies, in this case the clearcutting of eucalypts. Such interactions would be expected to allow consistency between activities and attitudes to develop and common group attitudes to emerge.

Attitudes are proposed as mediators in decision-making about technology choices. Janis (1982) provides examples of the effect of attitudes and personal bias among political decision-makers, while Wolfe (1981) provides examples among environmental legislators.

The theoretical framework developed in this chapter suggests the potential relationships between the components of the forester-forest ecosystem that may have some bearing on foresters' attitudes towards clearcutting of eucalypt forests. Attitudes of foresters can be examined in terms of this framework and also in terms of the factors suggested by Cognitive Dissonance theory (Festinger, 1957), and Social Interactionism (Mead, 1967). The approach taken in this thesis emphasises the complexity of human social responses. Although it cannot account for all of these complexities, it attempts to alleviate some of the problems of using unitary or simplistic theory to describe human behaviour.

In the following chapter, the theoretical framework is examined in terms of developing a research methodology, and suggests a research structure within which all variables are defined.

CHAPTER 4

APPLYING THE SOCIAL ECOLOGY MODEL

In developing a research strategy for this study, consideration was given to the nature of variables that would provide the data to examine variation in attitudes among foresters. It was necessary to consider the nature of attitude and operational constructs in order to obtain attitudinal responses.

Chapter 3 described the nature of attitude and indicated a possible methodology for obtaining measurement of the three components (cognitive, affective and conative) necessary as an adequate attitudinal response. The measures of attitude are the dependent variables and are described briefly here and in more detail in Chapter 5.

Attitude differences were shown to arise from a number of sources, and several theoretical approaches were examined to identify such sources. These sources relate to differences in experience and geographic location, occupation, and involvement in the environmental movement. Such sources of attitude difference are independent variables and are also described here.

Both the dependent and independent variables are related through the social model described in Figure 3.3. It is thus the purpose of this Chapter to document how the abstract concepts described in the previous

Chapter are related to quantifiable variables, and thus to provide the basis for describing the actual research process in Chapter 5.

DEPENDENT VARIABLES

The dependent variables in this study are the attitudes of foresters to clearcutting. The issues that need to be covered are detailed in Chapter 2 and include the environmental issues of concern to various groups in society, including professional foresters, about the clearcutting of eucalypt forests. These major problem areas represent the 'content domain' that needs to be sampled in order to determine foresters' attitudes towards clearcutting. This encompasses a wide range of forest management practices and their effects on the forest environment.

This set of environmental issues was derived from submissions and research findings about clearcutting (Table 2.4). Selection of issues was based on what individuals and groups considered were important in protecting environmental values.

Nine major issues were repeatedly raised by groups and individuals who made comments or submissions to Government inquiries. They can be subsumed into six broad areas, which are identified under 'Forestry dimension' in Table 4.1. Chapter two (Table 2.3) provides details of the specific environmental effects that were sampled in order to measure attitudes.

The most appropriate mechanism for obtaining attitudinal responses to these issues was by written responses.

The sub-issues were thus used to devise statements or items for inclusion in a written questionnaire, which is described in Chapter 5, and covers the 'content domain' concerned with the effects of clearcutting on eucalypt forests.

As this study is concerned with documenting attitudes and the sources of attitude differences among foresters, direct relationships between the cognitive, affective and conative variables are not examined, although such relationships are assumed in the attitude model, and have been demonstrated for many attitude issues (Ajzen and Fishbein, 1982). However, the method employed by this study allows relating these components together, but is outside the scope of this work.

TABLE 4.1

Major problem areas identified with the clearcutting of eucalypt forests

Forestry dimension	Major issues
HYDROLOGY	soil erosion and nutrient losses water quality and flooding
RECREATION	recreation opportunities
ECOLOGICAL EFFECTS	ecological stability of forest ecosystems regeneration of new forest
LANDSCAPE	aesthetic and landscape quality
PESTS AND DISEASE	pest and disease outbreaks
WILDLIFE	wildlife habitat wildlife species survival

INDEPENDENT VARIABLES

Sources of variation in social situations that could lead to potential differences in attitudes, arise from differences in the social interactions that foresters may experience within their forestry environment.

These sources of variations correspond to quantifiable variables. It is the result of interactions between various of the social or environmental dimensions illustrated in Figure 3.3 that provide the theoretical basis for differences in attitudes to arise.

The independent variables in this study are related to differences in the nature of social interactions in different social situations defined below and previously in Chapter 3.

1. Interactions between a social organization and a resource environment.

Foresters in the different States may experience differences in the nature of forestry practice discussions and communication because of differences in the forest silviculture practised in the various States. The various States were grouped as 'clearcutting' or 'non-clearcutting', which indicated the 'territory' or physical location of a forester.

Thus, an independent variable arises from differences in the physical location of foresters in a 'clearcutting' or 'non-clearcutting' State. This variable is labelled the 'territory' effect and is examined in Chapter 6.

The nature of forestry practices in the various States also provides a basis for differences in actual direct experience with those practices. The silvicultural practice of 'clearcutting' versus 'non-clearcutting' allows definition of differences in experience. Thus, direct field experience and management experience with clearcutting provides another source of variation in social interactions and the independent variable of effect of experience in clearcutting. This is dealt with in Chapter 8.

Both the above also represent differences in social environments experienced by the forester and are dealt with under that heading.

Different forestry activities such as field operations, research, forest management, administration, wildlife management and the like reflect different occupational roles and relate to different functions within forestry organizations. Each of those types of activities would occur in different types of social environment, in which different types of forestry matters are important, and different approaches are needed to carry out those activities.

The effect suggested by differences in occupational role relates to differences in position in organizational hierarchies, and this effect provides an independent variable that can be labelled the effect of hierarchical position or occupation and is examined in Chapter 9.

2. Interactions between a social organization and technology decision-making.

Foresters holding different positions in forestry organizations would be expected to have differing access to policy decision-making. The various occupational roles determine which position in such organizational hierarchies a forester would hold. Thus, occupational role can also be examined in terms of the potential access such roles would allow to policy decision-making, and how this affects attitudes towards clearcutting.

The potential access to policy decision-making represents an independent variable and is described in Chapter 10.

3. Interactions between a social organization and other social arenas.

As social interactions among persons participating in various activities draw them into the 'group', foresters who participate in the activities of the conservation organizations outside of the Institute of Foresters are drawn into social interactions with members of such organizations. Such social interactions could affect the attitudes of foresters in such situations. Thus, membership of conservation organizations other than the Institute constitutes a quantifiable variable allowing examinations of the effect of social interactions foresters have with non-forester members of the conservation movement. This independent variable also represents a social environment effect, and is examined in Chapter 7.

The above quantifiable variables represent the independent variables used in this study to examine sources of variation in the attitudes of foresters towards clearcutting.[1]

RESEARCH STRUCTURE

The dependent, independent and other variables relevant to this study are described in Table 4.2 in terms of the social ecology model presented in Chapter 3 (Figure 3.3). This table provides a summary of the relationships between the dependent, independent and other variables described previously, and provides the research structure for the study. All elements of the research to obtain foresters' attitudes and examine sources of variation in attitudes are derived from this structure.

This research approach provides the opportunity to explore attitudes towards clearcutting and sources of attitude variation from a new perspective, and may

1 The order of Chapters dealing with these independent variables differs from the order of the variables as described above and in Table 4.2 in order to describe the effects from the least to the most complex in the body of the thesis.

provide insight into some underlying social and environmental processes acting to generate differences in attitudes between social groups.

In the next Chapter, the research approach is taken a step further and details of the actual procedures and questionnaire are provided.

TABLE 4.2

Foresters' Attitudes towards Clearcutting:

A Social Ecological Framework

SOCIAL ECOLOGICAL CONCEPT[1]	CORRESPONDING FORESTRY APPLICATION	RESEARCH VARIABLE[2]	
Dependent Variables			
SOCIAL RESPONSES	Social attitudes of foresters towards clearcutting certain eucalypt forests	Beliefs about the effects of clearcutting	Cognitive dimension
		Beliefs about the seriousness of effects	Affective dimension
		Beliefs about how to reduce these effects	Conative dimension
Independent Variables			
(A) Interactions between a social organization and a resource environment			
(i)	Effect of residence in a forestry 'territory'	Location in 'clear-cutting' or 'non-clearcutting' State	

NOTES 1 As identified in Figure 3.3

2 Measurement of forestry application

TABLE 4.2 (continued)

SOCIAL ECOLOGICAL CONCEPT	CORRESPONDING FORESTRY APPLICATION	RESEARCH VARIABLE
	(ii) Effect of experience with the forestry operations in a territory	Direct field operations experience with clearcutting
	(iii) Effect of experience with managing forestry programs in a territory	Management experience of clearcutting eucalypts
	(iv) effect of occupational activities within the forestry 'hierarchy'	Occupational activity as organizational functional role
(B) Interactions between a social organization and technology decision-making		
	Effect of potential access to policy decision-making about forestry technologies	Position of functional role in a hierarchy of access to decision-making
(C) Interactions between a social organization and other social arenas		
	Effect of participation in and commitment to ideology of conservation organizations	Membership of conservation organizations

TABLE 4.2 (continued)

SOCIAL ECOLOGICAL CONCEPT	CORRESPONDING FORESTRY APPLICATION	RESEARCH VARIABLE	
Other elements of research framework			
SOCIAL ORGANIZATION	Population of Foresters	Foresters in the Institute of Foresters of Australia	
RESOURCE ENVIRONMENT	Australian eucalypt forests subject to clearcutting programs	Location of forest types across Australia	
TECHNOLOGY	Silviculture	Clearcutting of eucalypt forests	
ENVIRONMENTAL EFFECTS OF A TECHNOLOGY	Postulated adverse environmental effects of clearcutting eucalypt forests	Effects attributed to the clearcutting of certain eucalypt forests by public and others	Content of items in cognitive, affective, conative dimensions of attitudes towards clearcutting of eucalypts

PART III

CHAPTER 5

RESEARCH METHOD

This Chapter expands the details provided in Chapter 4 and describes how the attitudes of foresters were sought, the important methodological considerations to be made, and the method used to quantify attitude responses made on a comprehensive questionnaire, which was distributed to a sample of Australian foresters.

The distribution method used to obtain responses to the questionnaire is described under 'SURVEY DESIGN' and the development of the written questionnaire, its design, item inclusion, analysis of responses and tests of validity and reliability under 'INSTRUMENT DESIGN'.

SURVEY DESIGN

DEFINITION OF SAMPLE POPULATION

The first consideration in this study was the sample population to be studied. This population corresponds to Australian foresters.

This population is spread across all States of Australia. However, a population of Australian foresters can be defined that provides access to this social group.

Such a population of Australian foresters is available in the Institute of Foresters of Australia. Most Australian foresters are members of the Institute, with membership approaching 1500 (Carron, 1985b). A second association also exists, the Association of Consulting Foresters, but this is small (50) and its members are also members of the Institute. The Institute provides the best access to Australian foresters; it would be extremely difficult and time consuming to identify most foresters any other way. A recently updated computer listing and sticky address system is also available, simplifying location of foresters and forwarding of questionnaires.

The Institute of Foresters of Australia being a professional organization representing the body corporate of the forestry profession in Australia is a most suitable parent population to draw on to study Australian foresters' attitudes.

The Institute as a parent population has a further advantage in that there is a relatively homogeneous background of education amongst membership, most being trained in Australia (Jennings and Bacon, 1983). Those trained in Australia were further constrained by a choice of only two or three institutions at any particular time; the Australian Forestry School or its successor, the Department of Forestry, A.N.U.; the Victorian Forestry School, Creswick, and the Faculty of Agriculture and Forestry, now incorporating the School at Creswick.

Despite the homogeneity amongst members' education, the publications of the Institute reveal considerable variation in attitudes among members, and a full range of opinions is represented.

DATA COLLECTION

Data were collected with a cross sectional survey utilising a mailed questionnaire to all listed members of the Institute, except those who participated in a pilot study. Mailed questionnaires were used for several reasons. Firstly, foresters are spread over a large continent and mailing gives access to foresters in all locations. Secondly, a larger number of foresters could be included, thus providing a larger data base and broader cross-section of the community. Thirdly, it would be too time consuming and costly to interview large numbers of foresters.

PILOT STUDY

To ensure that the questionnaire developed for this study was the best possible to obtain the attitudes of foresters, the structure and wording of all items was pretested on forestry academics (Department of Forestry, A.N.U.) and fourth year forestry students.

This led to the revision of many items, and the addition of further items necessary to cover some issues adequately, and standardisation of instructions.

SURVEY PROCEDURE

A total membership survey of the Institute of Foresters was undertaken in Australia in the latter part of 1982, involving 1284 members listed on the official computer file held by the Institute at November 1982. The mailed questionnaire (Appendix A sleeve insert) was forwarded in a pre-addressed envelope and included both an introductory letter on the first page plus a separate letter encouraging early returns.

A reminder letter was placed in the Newsletter of the Institute two months after the initial mailing. In spite of a postal dispute and the Christmas season, the initial response of 60 percent to the survey compares favourably with the response to similar surveys (Jennings and Bacon, 1983; Glascock 1977;1979).

Because all members were sent questionnaires, the respondents represent a 'self-selected' sample. The possibility of bias always exists from self-selection, but the distribution of respondents and size of sample provides some confidence that the sample tapped a wide cross section of foresters. The distribution of members by State (Table 5.1) shows that no State was over-represented.

TABLE 5.1

The distribution of response to questionnaire by State of membership

STATE	% MEMBERS	% RESPONDENTS
Australian Capital Territory	8.1	8.9
New South Wales	28.2	21.1
Victoria	26.4	27.1
Queensland	11.4	10.8
South Australia	8.9	8.3
Western Australia	9.9	10.2
Tasmania	10.0	11.8
Northern Territory	.8	.4
Overseas (A.C.T.)	1.1	1.3

$Chi^2 = 1.29$; $df = 8.00$

(Chi^2 0.05 (8) = 15.51)

∴ Accept H_o: no difference in proportions by State

REACTIONS TO QUESTIONNAIRE AND SURVEY

Many foresters made detailed comments on the questionnaire ranging from minor adjustments to specific items, problems encountered in using the response categories, and general comments about clearcutting in Australian eucalypt forests. Many foresters applauded the importance of such a study and indicated their belief in this importance by responding in large numbers to the survey.

There were very few questionnaires in which incomplete data occurred, less than 3 percent, and this was overcome by recording such responses as missing.

Some foresters reacted strongly to the notion that clearcutting caused environmental impacts with such statements as 'I can only indicate how serious an effect is if I believe it happens in the first place'. There was a tendency for such comments about the effects of clearcutting to come from foresters in those States which were grouped into the 'clearcutting' category.

Comments by a few foresters implied the study was a personal attack on themselves, reacting with strong emotional language to the intent of the questionnaire.

The comments, however, ranged from distinctly hostile to the very supportive, and emphasised that the issue of clearcutting in Australian eucalypt forests was highly charged with emotion for some, and of considerable importance to most.

The results of the study will assist in documenting what Australian foresters do believe about the effects of clearcutting in eucalypt forests.

INSTRUMENT DESIGN

The dependent and independent variables used in this study were expressed as questions in a written questionnaire (Appendix A). The dependent variables, as indicated previously, correspond to measures of the attitudes of foresters towards clearcutting. The independent variables correspond to measures indicating variations in social conditions.

MEASURING ATTITUDES TOWARDS CLEARCUTTING

Cognitive Dimension

The first attitude response type, the cognitive dimension, requires determination of the 'subjective probability' that some object (physical or philosophical) has certain attributes associated with it; i.e. the perceived probability that there is an association between some object and an attribute. A forester, for instance, might believe it highly probable a forest operation will cause some soil erosion, or highly improbable that it will not regenerate following logging. This attitudinal dimension was assessed by asking foresters to respond to items that suggested certain environmental effects were associated with clearcutting. The question providing the link between clearcutting and the environmental effects (Table 2.3) asked for responses in terms of subjective probabilities, as was as follows:

> "How probable do you think each of the following postulated adverse effects is for native forests under clearcutting programs?"

This question was followed by 17 separate items, each with the set of response categories.

The categories used for this set were as follows, with the accompanying numerical values.

1 = not at all (probable)	2 = not much
3 = somewhat	4 = highly
5 = very highly	6 = uncertain
	7 = insufficient information

The response categories in terms of subjective probability values rather than questionnaire categories are shown in all tables for the attitude scales related to the cognitive dimension in Chapters 6 to 10. The correspondence between the questionnaire categories and the subjective probability values are as follows:

1 = 0.010	2 = 0.245
3 = 0.490	4 = 0.735
5 = 0.990	

The use of 0.010 and 0.990 to limit the probability range rather than 0 and 1.0 follows the suggestion by Kiely-Brocato et al (1980).

The pilot study suggested the two categories, 'uncertain' and 'insufficient' information would be necessary to facilitate responding. Although these were used rarely, their absence could have alienated some respondents.

Responses to such items can be used to build attitude indices of the cognitive dimension, which is described under QUANTIFYING ATTITUDE SCORES later in this chapter.

Affective Dimension

The second response type (the affective dimension) requires an evaluation of these attributes (the environmental effects) associated with the object (clearcutting of eucalypts); for example, how serious foresters believe the postulated soil erosion might be from clearcutting operations.

This dimension of attitude was assessed by asking foresters to rate the seriousness of each postulated environmental effect with the following:

> "Indicate how serious you consider each of the postulated effects is from clearcutting native forests."

Similarly, a set of items (16) followed this, each with a set of response categories.

The response categories were as follows:

1 = not at all serious	2 = not very serious
3 = somewhat serious	4 = very serious
5 = unacceptable	6 = uncertain
	7 = insufficient information

Responses were coded 1 to 5 as in the question category, with categories 6 and 7 recoded as missing.

Responses to these items can also be used to determine attitude indices for the affective dimension, the categories being given a numerical value as above.

Conative Dimension

The third response type (the conative dimension) has been included in attitude studies for many years to check on the empirical validity of attitude measurement. Because of the impossibility of observing actual behaviour, and the difficulty of devising behavioural items relevant to all foresters, the conative component was assessed through 'intention-to-act' (Fishbein and Ajzen, 1975).

To arrive at a suitable assessment, consideration was given to the types of behaviour that might be related to the expression of an attitude towards clearcutting. As the environmental effects of clearcutting depend not only on direct impacts, but also on preventative and rehabilitative practices associated with forest harvesting, an intention-to-act 'substitute' related to these practices seemed a fruitful area to consider. Thus, it was possible to ascertain foresters' beliefs about how different environmental protection procedures reduced the impacts or effects of logging operations on the forest.

Thus, foresters were asked to indicate how much they agreed with propositions suggesting ways of reducing the environmental effects of clearcutting; such as, "more habitat trees should be left uncut in each clearcut unit of native forest".

These responses were obtained to the following:

"For this set of items, indicate how much you agree with the statements". Following this were 20 separate items, each with a set of response categories.

The response categories being:

1 = not at all	2 = not much
3 = somewhat	4 = a lot
5 = totally	6 = uncertain
	7 = insufficient information

Such responses can be used to determine attitude indices for the conative dimension.

Each of these attitude dimensions represents a dependent variable in this study. Each attitude type was assessed through several items. The scores on these items were analysed by factor analysis to produce scales with relevance to the different types of issues in each set of items. Different numbers of scales were obtained for each attitude dimension depending on the inter-relationships between responses to the different items.

QUANTIFYING ATTITUDE SCORES

The multivariate technique of factor analysis was used in this thesis to develop attitude scales from responses to items on the questionnaire. This technique is useful to reduce a large number of item variables into variables consisting of groups of related items. This procedure allows identification of the main dimensions represented by the items within the data set, and produces factors of related items (Gould, 1981). The items that define each factor can then be treated as a scale.

Such a procedure appeared to be relevant to the present study in identifying the empirical 'content dimensions' within each set of items. In other words, the items representing the cognitive, affective and conative dimensions were factor analysed to develop a reduced number of attitude scales.

This reduces the complexity of dealing with many dependent variables (all items) and provides groups of items which are more managable for analysis and interpretation.

Factor analysis can also be used to provide scale 'scores' for each person, on each of the dimensions shown to underly the data set. Thus, each person will have a score on each attitude dimension found to underly the cognitive, the affective and the conative items.

Levine and Langenau (1979) used a similar approach in developing scores for recreational activity sets, using cluster scores of the activity variables.

The factors are, however, mathematical abstractions and transformations of the original data. They represent a summary highlighting the major dimensions of the attitude of interest and the relevant items defining those dimensions.

Factors derived from a particular set of data variables can be constrained to be orthogonal, and hence independent of each other. The factors represent associations among the data variables, which describe the nature of the variables, but do not prescribe the nature of relationships between these and other variables. Factors can thus be used as more compact descriptions of the original data from which they were derived.

The procedure to obtain factors and to test the reliability and validity of these factors involved four steps:

(1) calculation of correlation coefficients among all the item variables for each attitude dimension;

(2) analysis of the correlation matrices resulting from step 1 in order to establish groups of related items (factors);

(3) assessment of the reliability of these factors as adequate measuring scales, and

(4) assessment of the validity of the factors for each set of items, as 'true' measures of the components of attitude they were designed to measure.

Steps 1 and 2 are described in the next section, while 3 and 4 are described under 'Psychometric Considerations' later in this Chapter.

FACTOR ANALYSIS OF QUESTIONNAIRE ITEMS

For each of the attitude dimensions and associated sets of items, a factor analysis was conducted to determine how the items were correlated with each other.

For the cognitive dimension, there are 17 items on the questionnaire. Although all items are related to some clearcutting issues, foresters may not respond to all items the same way. Thus, responses to soil erosion on stable soils may be related to responses to soil erosion on unstable soils, but not to responses to canopy bird effects. The way foresters responded to these items provided a means to group the items into empirically related 'factors' or groups of correlated items.

Correlations Among Items

All items included in the questionnaire were drawn from consideration of questions raised about the environmental effects of clearcutting within eucalypt forests (Table 2.3). Thus, within the questionnaire, there are groups of items for each of the issues identified in Chapter 2. In order to determine the strength of the relationships between items related to a single issue, 'product moment' correlations were calculated for the whole set of items associated with the cognitive, the affective, and the conative dimensions separately.

All items used a five category scale, with the 'insufficient information' and 'uncertain' categories recorded to missing data. The categories were designed to measure as closely as possible, equal differences between the categories. Thus, the correlation matrix calculated by the SPSS statistical package (Nie et al,

1981) was considered to be suitable in producing the intercorrelation matrix for factor analysis.

Population for Factor Analysis

Before proceeding further, it was also necessary to determine whether the whole respondent population might be used to establish the intercorrelation matrix used for the factor analysis of each set of items (The cognitive, affective, and conative), or whether there might be sufficient inter-population differences within the profession to make this inappropriate. For instance, in Chapter 2 it was shown that some forest management practices differed between the States of Australia, and that four States: N.S.W., Victoria, W.A. and Tasmania had major clearcutting programs, while the other States: S.A., Queensland, N.T. and the A.C.T. did not. It was thus necessary to establish whether there were any major differences between the intercorrelations among item variables for these 'clearcutting' and 'non-clearcutting' States.

For example, do the responses of foresters from 'clearcutting' States to items on the probability of effects of clearcutting produce correlations between these items which are similar to the correlations between the same items for the 'non-clearcutting' States.

A test that can be utilised for this purpose is the Box test, which is described in detail in Cooley and Lohnes (1971). This test was used to test the null hypothesis; the equality of the intercorrelation matrices for the two State groups, 'clearcutting' and 'non-clearcutting'. This test was applied to each set of items corresponding to each dimension of attitude. This test provides the usual 'F radio', which can be tested in the normal way (see Appendix D for details).

This statistical test showed that for items in the cognitive dimension, F = -0.11 which is not significant, where ($F_{0.05}$= 1.0) and suggests there was no difference in the inter-correlation matrices between these sub-populations of the profession, that is, the two sub-populations of 'clearcutting' and 'non-clearcutting' foresters were grouping the same items together. This is not to say that foresters in both sub-populations gave the same level of response.

For the affective dimension the Box test produced an F of 1.93 which suggests there may be some differences in these two groups on these items. However, there were essentially no major differences in the factors that emerged, and the existence of random error may have produced the significant level for F. For the conative dimension, the Box test produced an F value of 0.27, which also shows the two intercorrelation matrices are essentially alike.

Thus, the two groups of foresters ('clearcutting States' and 'non-clearcutting States') were considered to be responding as members of a single population in terms of the relations among the items. The two groups could thus be combined with N=702, and new correlations calculated for the total sample for each set of items (dimension of attitude).

Finding Factors and Factor Scores

The three intercorrelation matrices based on N=702 were used for the next step of the analysis.[1] This required reducing the redundancy in the correlation matrices and finding the groups of item variables that were highly correlated among themselves, but less correlated with the other item variables. The procedure used here was a principal axes analysis with iterations (Nie et al, 1981) a refinement of Principal Components analysis (Thurstone, 1947). The analysis was carried out with the SPSS statistical package, version 9, using the PA2 procedure of FACTOR, with an interative process to find the initial factors. However, if the analysis is left at this point, a general factor and bipolar factors emerge, as illustrated in Figure 5.1 for the general factor and first bipolar factor for the items in the 'affective' dimension.

The unrotated, initial factors I and II show all variables have high correlations with the general factor I, some are positive, the rest negatively correlated with factor II. This analysis has limited value, as the bipolar factors and a general factor do not provide the

1 Each set of items (cognitive,affective and conative) produced an intercorrelation matrix.

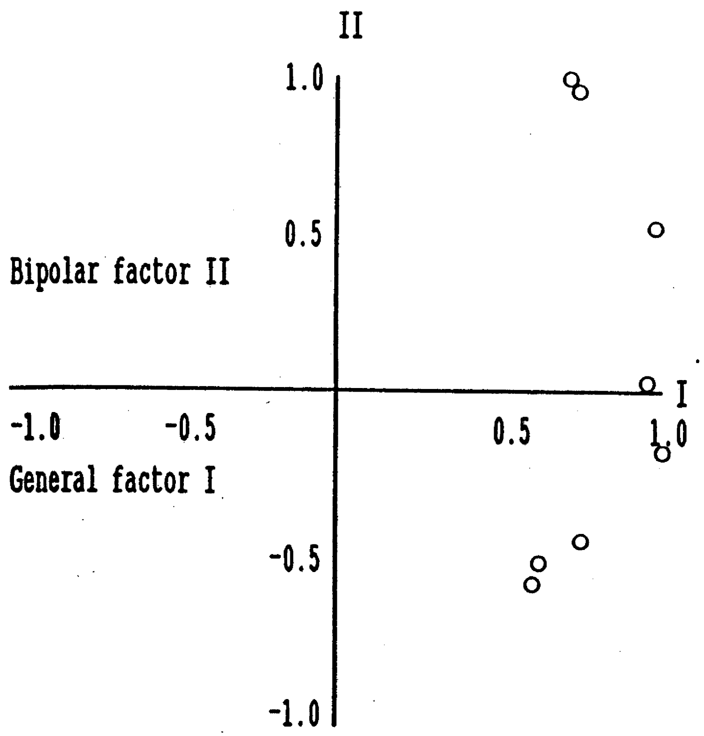

FIGURE 5.1
GENERAL FACTOR AND FIRST BIPOLAR FACTOR

AFFECTIVE DIMENSION

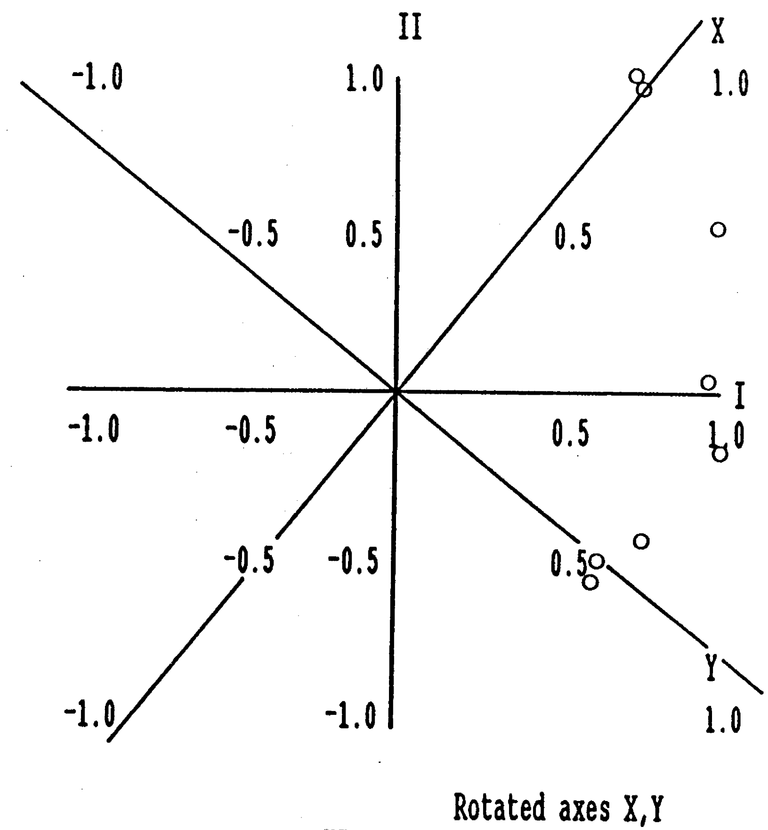

FIGURE 5.2
ROTATED FACTOR AXES

AFFECTIVE DIMENSION

most simple interpretative 'model' of the data. In fact, if an analysis is left at this stage, the groups of items in the bipolar factors could be interpreted as non-existent (Gould, 1981).

To overcome this problem, and identify the groups of items obscured in the initial analysis, the factor axes I and II or whatever emerges, can be rotated so that they are positioned near the groups of items and various criteria for positioning applied. These criteria can be applied to produce new coordinates for each item variable that are high and positive on one factor, but low or zero on the others (Figure 5.2).

Rotation of factors was carried out in this analysis using a VARIMAX orthogonal rotation. This procedure thus enabled identification of the groups of items that were significantly correlated with a single dimension (a factor), and not with other factors. However, there are many orthogonal factor positions that could be generated in such an analysis as this, and the solution accepted is only one way of describing the data (Cooley and Lohnes, 1971).

Each factor has a mean of zero and variance of one, with the factor 'loadings' representing both correlation coefficients and regression coefficients. Thus, the loadings show the correlations between each item variable and each factor, and the regression coefficients between each item variable and all factors.

Further details on factoring procedures are shown in Harman (1967) Cooley and Lohnes (1971) and Nie et al (1981).

All default options of the FACTOR procedure were utilised for the analysis presented here. Inferred factors were obtained as no assumption was made prior to the analysis of the number of factors to be derived. However, only factors with an eigenvalue of 1.0 or greater were retained and used in the rotated solutions.

See Appendix E for the detailed analyses of the cognitive, affective and conative dimensions.

PSYCHOMETRIC CONSIDERATIONS

Error can arise from the use of any measuring instrument, and particularly from the type of data collected by interview or written questionnaire. There are, however, a number of techniques that can be used to reduce this potential error.

Error associated with answers to written questionnaires can arise from variable and random sources, such as response sets (a propensity to answer all questions in a certain way), eg acquiescing, socially desirable responses, and misinterpretation of questions.

The techniques utilised in the questionnaire were designed to reduce the above sources of variable error as much as possible. Each set of items was randomised to reduce the effect of response 'set' or bias. Leading questions were avoided, and statements were presented as neutral propositions to maintain an objective and unbiased presentation of the issues. All attempts were made to ensure only one issue was associated with each item in any particular set.

Error can also arise when a measuring instrument is not a valid index of the concept under study. The question of internal consistency of the attitude scales was examined through the use of factor analysis and through the calculation of alpha reliability coefficients, detailed below.

RELIABILITY OF ATTITUDE SCALES

The assumption underlying the use of a scale of items to measure a psychological dimension such as attitude, is that the scale will provide an accurate estimate of the true score of individuals within a given population on that dimension (Cronbach, 1951).

The scales used for this purpose in the research presented in this thesis were factor scales derived from factor analysis of the three sets of items (Appendix E).

An estimate of the accuracy of the estimates of 'true' scores can be made by determination of the proportion of a score that is attributable to errors of measurement compared with that proportion attributable to actual measurement. That is, finding the coefficient of reliability from the formula:

$$\text{alpha} = 1 - \frac{\sigma_e^2}{\sigma_o^2}$$

where σ_e^2 is the error variance and σ_o^2 the observed score variance.

This computation applies to scales that are based on scores derived from raw data and requires that a scale is additive. In the case of factor scales, these are already additive as they are linear transformations of the raw data into factor dimensions. As the factors represent linear regressions along the factor plane, the coefficients used to compute the factor scores represent weights, which take account of the error variance within the data.

Thus, the factor scales are expected to be very reliable estimates of a person's 'true' score on the content dimensions of the factor (Cooley and Lohnes, 1971). However, if raw scores were used to calculate a scale score, the reliability would be somewhat less. The factor score conversions of the raw data cannot be used directly to calculate the reliability coefficient of a factor scale, but a minimum estimate of the reliability could be found from analysis of the scales had the raw scores only been used, using the grouping of items from the factor analysis. This sets the lower limit to the reliability of the factor scales. As Rummel (1970) notes, scales based on scores from factors with eigenvalues grater than 1.0 are generally considered reliable.

The assumption that items in a scale are measuring the same thing is amply met by the factor scales. Reliability estimates based on the items in the factor scales also meet the assumptions underlying the use of the analysis with respect to the assumed independence of measurement of items, large size of data set and population of items.

The maximum likelihood estimate of alpha was used as an estimate of the reliability of the factor scales' minimum reliability estimate using raw scores summed for the items on the factor scale. The SPSS RELIABILITY program was used for this. The coefficients are shown in Table 5.2. The main factor in reducing the reliability of the actual factor scales is the number of items in the factor scales. This is also reflected in the estimates for the raw score scales.

The coefficients for the raw score calculation show reliabilities between .40 and .91, suggesting the factor scales would have good reliability for most scales even without the advantage of the factor score coefficient weights.

TABLE 5.2

Reliability coefficients: maximum likelihood estimates of 'alpha' for raw 'factor scales'

FACTOR SCALE	NUMBER OF ITEMS	COEFFICIENT ALPHA
Cognitive		
AMBIA	7	.75
HYDROL	4	.79
ECOL	3	.69
NUTRIN	3	.62
Affective		
ECOEFF	3	.91
LANDSC	3	.68
HYDEFF	5	.83
Conative		
HYDSTR	4	.74
LNDSTR	3	.66
PSTSTR	2	.76
REGSTR	4	.59
WLDSTR	2	.70
SILSTR	4	.60

VALIDITY OF ATTITUDE DIMENSIONS

The notion of validity in the measurement of a psychological dimension is the degree to which a measuring instrument indicates the 'true' score it was designed to measure. The presence of constant error will reduce a measure's validity, as the observed score will be consistently contaminated by some irrelevant factor (Kothandapani, 1971).

Guilford (1954), Edwards (1957) and Scott (1968) discuss various ways to reduce these sources of error, as do most texts on survey or questionnaire design. The extent to which such sources of constant error are eliminated from an instrument can be assessed by examining the validity of the instrument as a measure of the theoretical concept under study.

The reliability of the instrument in providing an assessment of a 'true' score free of variable error is discussed previously.

The most basic aspect of validity relates to 'face' validity, i.e. acceptance of a measuring instrument (e.g. the questions on a questionnaire) by the target population of a survey. Comments on the questionnaire suggested the items were in fact acceptable to foresters and relevant to the issues under study. The large response to the survey from foresters in all States, all age and management experience groups, over a wide range of forestry occupations verifies the face validity of the items in the questionnaire.

The content of the items is also a valid representation of the dimension important to the clearcutting of eucalypts. This content was derived from many sources, and all major areas of concern were included.

The empirical validity of the questionnaire and the attitude scales cannot be measured directly, as no actual behaviour was assessed against which to correlate attitude scores. However, differences in attitudes between different groups should provide such validation.

It is possible to test the convergent and discriminant validity of the different attitude dimensions and the scales derived to measure these. Convergent validity refers to whether scales within a particular dimension are each measuring that dimension. Discriminant validity refers to whether two measures used to measure two different components or dimensions do in fact measure only the components intended.

Convergent and Discriminant Validity

The method of correlation analysis as suggested by Kothandapani (1971) is used to test these validity assumptions.

Correlations among the different factor scales of each attitude dimension are used to test the convergent validity of these scales. This technique is similar to the 'multi-trait--multi-method' approach of Campbell and Fiske (1959), with the multi-method component being replaced here by the different scales. Appendix F details these calculations.

Construct Validity

The 'construct validity' of attitude as a psychological dimension that differentiates people according to their scores on an attitude measuring instrument is established throughout this thesis. Further evidence confirming the discriminating ability of the three attitude components among foresters to the issue of clearcutting is given through the thesis in Chapters 6-10.

MEASURING INDEPENDENT VARIABLES

The independent variables were measured by responses to specific questions included on the questionnaire.

The location of a forester in a particular State was identified by a date code.

A single question was asked seeking a YES or NO response to a forester's field experience with clearcutting in eucalypt forests. A coded question was used seeking the number of years of management experience with clearcutting eucalypt forest using four categories (see questionnaire). A single question seeking membership of conservation organizations other than the Institute of Foresters of Australia was also included. Foresters were asked to identify the forestry activity they mostly engaged in; this was used to identify their occupational role. Each of these questions is used in later analyses to examine the effects of variations in social environment and social experience.

STANDARD PRESENTATION OF DATA

The basic analyses for all sources of variation in attitudes are presented in a similar way throughout the remainder of this thesis. Where there is excessive data to include both basic scale information and the statistical analysis, these are presented in separate tables.

The standard format for presentation is as follows:

ATTITUDE SCALE	Group A scale mean	SD	item mean	Group B scale mean	SD	item mean	F-test	P
<u>Cognitive</u>								
AMBIA	xx	x	xx	xx	x	xx		
HYDROL								
ECOL								
NUTRIN								
<u>Affective</u>								
ECOEFF								
HYDEFF								
LANDSC								
<u>Conative</u>								
HYDSTR								
SILSTR								
REGSTR								
WLDSTR								
PSTSTR								
LNDSTR								
N		xxx				xxx		

Where there are only two groups being compared, the univariate F tests are included in the same table, otherwise they are presented separately.

The scale means in all cases refer to the attitude scale mean for the group. Because these scales are factor scales, and scores are factor scores, the mathematical mean of all scores for the various scales is in fact zero, the scale means being expressed as z scores.

The standard deviation refers to the standard deviation for factor scores of members of each group, the standard deviation for all scores being 1.0. To provide psychological meaning to these scores, the scale means are converted to item means for each scale. This transforms the z score format to raw score format and the procedure is detailed in any standard statistics text for transformations of one score distribution to another.

The item means indicate the mean response for all items within a particular scale for a particular group. Item means correspond to the response categories on the questionnaire. The item means for the cognitive scales are expressed in terms of subjective probabilities, the correspondence to response categories being described previously.

Where a scale mean is negative, the mean of the distribution of scores for that group occurs below the mean of all foresters' scores for that scale. Likewise, a positive mean indicates the mean of the distribution of scores for the group occurs above the mean for all foresters' scores.

Because of the nature of the scales, negative means reflect a distribution of scores corresponding to lesser agreement on the items in the questionnaire, and positive means reflect a distribution of scores corresponding to a greater agreement on items.

To illustrate the differences between the groups compared in Chapters 6 to 9, the scale means are transformed to positive numbers and plotted in a profile format. The mean of all scores is represented at 50 on the transformed scale as illustrated in Figures 6.1, 7.1, 8.1 and 9.3, and in Figure 8.2 where the transformed mean is 100.

PART IV

CHAPTER 6

THE EFFECT OF SOCIAL ENVIRONMENT I

"TERRITORY"

In Chapter 3 we examined some social factors that might influence the attitudes of member's of a social organization. It was noted that group attitudes were associated with participation in common activities within a social group. Mead's (1967) discussion of social interactions and how these affect attitudes led to the proposition that foresters in those States with opportunities for social interactions about the clearcutting activities of their State might differ in attitude from foresters in States without clearcutting activities.

Location in States where opportunities exist for social interactions and discussion about clearcutting activities is described as the dimension of 'territory' in the social ecological model presented in Figure 3.3. Similarly, location in 'non-clearcutting' States can also be described by the concept of 'territory'. Attitude variation might arise because of the different activities engaged in by persons in different social groups, such as the differing silvicultural practices in the eucalypt forests (Table 4.2) utilised by 'clearcutting' and 'non-clearcutting' States.

Association with clearcutting activities and social interactions among foresters within a given territory might affect their attitudes towards clearcutting. The possibility of such effects is thus the subject of this chapter.

Given the tendency for people to reflect a degree of consistency between their attitudes and activities (Festinger, 1957), we might expect those foresters who are located within the 'clearcutting' territories to support those activities at an individual level. As Mead (1967) proposed, similar or common social activities would lead to similarities in attitudes among members of the social group. Thus, we might expect the attitudes of foresters within the 'clearcutting' States to be similar, and those of foresters in the 'non-clearcutting' States to differ from those in 'clearcutting' States.

These theoretical propositions do not tell us how much we might expect attitudes to differ, except that the more similar the activities, the more similar the attitudes might become (Mead, 1967).

This chapter thus analyses the way foresters responded to the written questionnaire (Chapter 5) in order to address the question arising from the theoretical considerations above.

Does the physical location of a forester in a particular forestry social environment, that of a 'clearcutting' State or a 'non-clearcutting' State have an effect on their attitudes towards clearcutting of eucalypt forests?

This question can be more specifically addressed by testing the hypothesis:

The location of foresters in the 'clearcutting' States generates attitudes supportive of clearcutting activities, which differ from the attitudes of foresters in the 'non-clearcutting' States.

We might expect attitude-activity consistency to occur within the group, and a group attitude to emerge reflecting an attitude consistent with the activities engaged in by foresters: 'clearcutting' foresters ought to be more favourable towards clearcutting than 'non-clearcutting' foresters. These propositions are tested in this Chapter.

THE EFFECT OF TERRITORY –

Social Interactions within a Forestry Environment

The attitude scales used in the analyses presented here were derived from factor analysis of foresters' responses (Chapter 5). The scale means for each group shown in Table 6.1 are z scores and illustrate the relative differences between the 'clearcutting' and 'non-clearcutting' States over the different scales. As indicated in the analysis described in Chapter 5, each attitude scale comprises a group of items related to a different type of issue.

The z score method used throughout the thesis indicates whether the distribution of responses for a group is above or below the mean for all individuals in all groups, and is more useful here to illustrate whether the group members' responses indicate lesser or greater agreement to items relative to one another.

Although the actual scores of foresters to questionnaire items may suggest disagreement with propositions, the standardisation of scores shows how they differ relative to each other for a particular scale.

However, when scale means are compared in this way it is not possible to tell what the level of agreement is for those scales. This is shown by the item means, which are expressed in terms of the response categories.

<u>TABLE 6.1</u>

The effect of 'territory' on attitudes - MANOVA

ATTITUDE SCALE	'Clearcutting' States Scale mean	SD	Item mean	'Non-clearcutting States' Scale mean	SD	Item mean	Univariate F-test	P
Cognitive								
AMBIA	-0.08	0.78	0.52	0.19	0.90	0.54	16.17	xxx
HYDROL	-0.13	0.92	0.49	0.32	0.98	0.53	35.88	xxx
ECOL	-0.09	0.74	0.28	0.22	0.77	0.37	26.03	xxx
NUTRIN	-0.13	0.69	0.32	0.31	0.89	0.35	51.63	xxx
Affective								
ECOEFF	-0.15	1.04	2.55	0.35	1.11	2.64	34.21	xxx
HYDEFF	-0.15	0.92	2.38	0.37	0.95	2.54	48.35	xxx
LANDSC	-0.02	0.78	2.33	0.06	0.95	2.34	1.21	NS
Conative								
HYDSTR	-0.10	0.80	3.23	0.24	0.85	3.37	27.91	xxx
SILSTR	-0.13	0.61	2.92	0.30	0.58	3.00	77.38	xxx
REGSTR	-0.05	0.68	3.90	0.11	0.63	3.97	8.14	xxx
WLDSTR	-0.03	0.74	3.70	0.08	0.74	3.71	3.36	NS
PSTSTR	-0.08	0.82	2.86	0.20	0.82	2.93	18.52	xxx
LNDSTR	0.02	0.83	3.20	-0.04	0.89	3.15	0.73	NS
N		494			208			

Multivariate test of significance F = 9.97; df 678 xxx $p < .01$

univariate df 1690

Notes:	Cognitive	Affective, Conative	Level of agreement
Item means	0.010	1	not at all
scale score	0.235	2	not much
(see Chapter 4)	0.490	3	somewhat
	0.735	4	a lot
	0.990	5	total agreement

A multivariate analysis of variance was applied to all attitude scales and these results are also shown in Table 6.1. Univariate F-tests are shown for each scale. As the scale means are shown as z scores, the corresponding item mean for each scale is also shown. The means for all foresters in each scale are shown in Appendix C.

The scale means are negative if the group mean is below the mean of the total sample, and positive if the group mean is above the mean of the total sample. An item mean of 0.49 (cognitive) or 3 (affective, conative) represents agreement in the centre of the scale; item means below these indicate disagreement with items, and item means above these indicate greater agreement. The relative differences between the two groups are illustrated using transformed scores between zero and 100, with a scale mean set to 50, in Figure 6.1.

As shown by the multivariate F test (Table 6.1), State location has a significant effect on the scores of foresters over the range of issues in the attitude scale. The univariate F tests indicate that foresters in the 'clearcutting' States differ in their scores on all except three scales (LANDSC, LNDSTR, WLDSTR) from foresters in the 'non-clearcutting' States.

In the four 'cognitive' attitude scales, both 'clearcutting' and 'non-clearcutting' State foresters agree that clearcutting has effects on landscapes and wildlife (AMBIA scale), with item means of 0.52 and 0.56

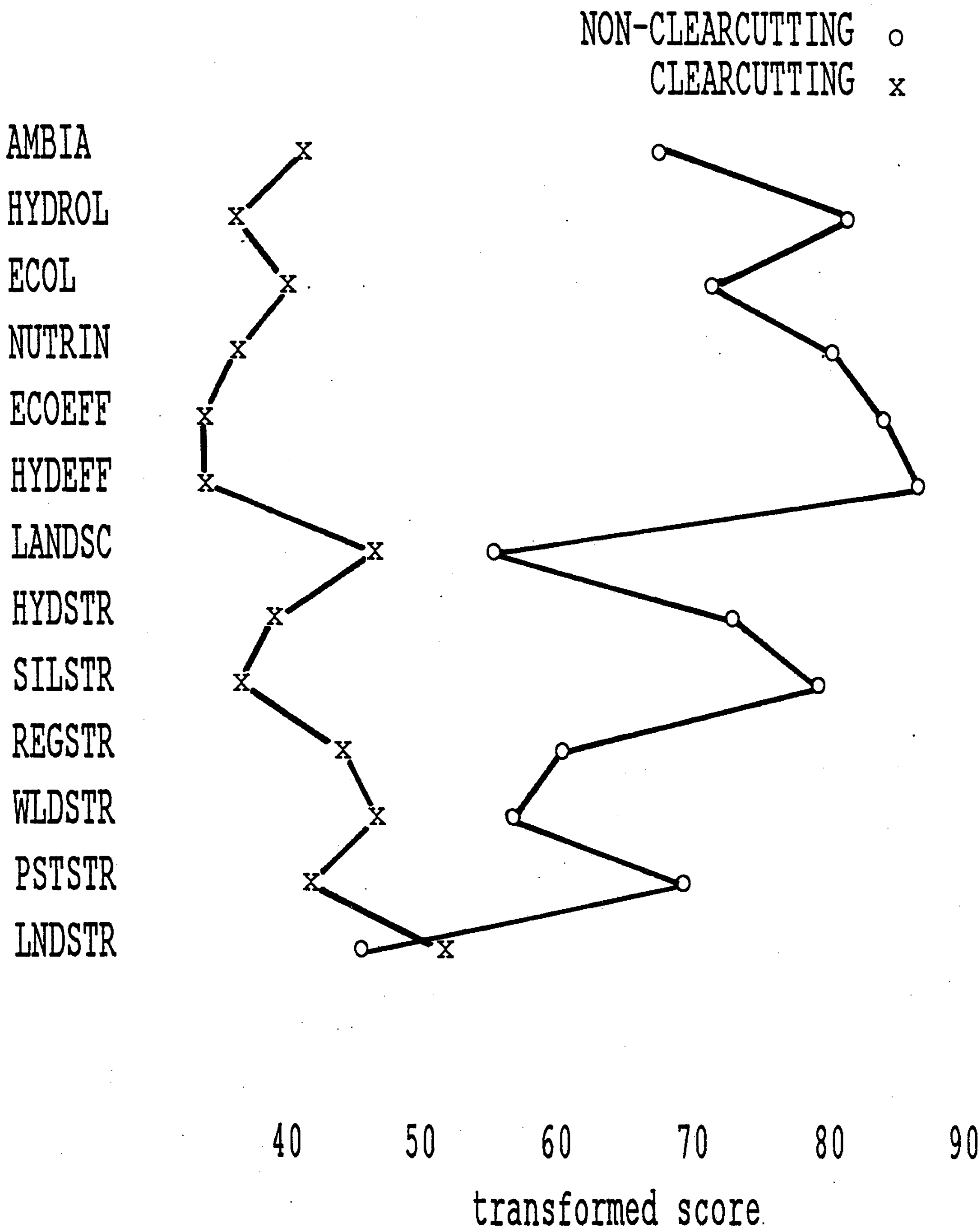

FIGURE 6.1

ATTITUDE VARIATION WITH TERRITORY

respectively, corresponding to mean agreement between 'somewhat' probable and 'highly' probable. On the HYDROL scale in comparison, the 'clearcutting' foresters are more likely to disagree that there are hydrological effects, item mean = 0.49, while 'non-clearcutting' foresters agree, item mean = 0.53. As the scale z scores and Figure 6.1 show, these two groups are in fact further apart on this scale among the four cognitive scales. On both the ECOL and NUTRIN scale, both groups disagree that there are effects. However, it needs to be noted that on all scales, the scores of the 'clearcutting' foresters are less than those of 'non-clearcutting' foresters, which indicates beliefs among 'clearcutting' foresters that clearcutting has less undesirable effects.

Foresters' beliefs about the seriousness of effects (affective scales) differ on the ecological (ECOEFF) and hydrological (HYDEFF) scales, but not on the landscape (LANDSC) scale. Although there are significant differences in scores for the first two scales, foresters in both groups generally disagreed that effects were very serious, with item means less than 3 for each scale (agreement below somewhat serious).

Of the conative scales, foresters in 'clearcutting' States differed on four scales, HYDSTR, SILSTR, REGSTR, and PSTSTR from foresters in 'non-clearcutting' States. Perhaps the most dramatic difference is between scores on the SILSTR scale. This scale deals specifically with alternatives to the use of clearcutting. Foresters in 'clearcutting' States disagree that there are alternatives to clearcutting in eucalypt forests, while foresters in 'non-clearcutting' States agree that alternatives are more appropriate. It needs to be borne in mind in this comparison, however, that as indicated in Chapter 2, there are fewer forests in the 'non-clearcutting' States suitable for extensive clearcutting (Table 2.1) and that many forest types located in the 'clearcutting' States (Table 2.1) are suitable for clearcutting.

That foresters in the 'clearcutting' States disagree with suggested alternatives does indicate their commitment to clearcutting is strong.

For the HYDSTR, REGSTR, WLDSTR, and LNDSTR conative scales (Table 6.1) both groups agree that there is room for improvements in environmental protection. For the PSTSTR scale, 'clearcutting' foresters disagree that pest and disease problems need more attention (item mean = 2.86), while 'non-clearcutting' foresters are more likely to agree that these problems need more attention, (item mean = 2.93).

SUMMARY

When all scales are compared, 'clearcutting' foresters have lower levels of agreement that effects are probable, that effects are serious and that environmental protection needs improving than 'non-clearcutting' foresters. On only one scale is the reverse true, LNDSTR. This difference is not of any great significance, however, as both groups agree generally that landscape protection needs adequate attention. The 'lower' levels of agreement about effects among the 'clearcutting' foresters suggest that there is greater support for clearcutting among these foresters.

These analyses suggest that location within a particular type of social environment, such as that which might arise within 'clearcutting' States, affects the attitudes of participants in the activities carried out within that environment. Kagan (1969) also found location in a particular social environment was associated with particular attitudes.

Location in a 'clearcutting' State leads to a reduced level of agreement to the items presented, reflecting more favourable attitudes towards clearcutting. Thus, in answer to the question proposed earlier, physical location in a particular social environment does affect foresters' attitudes, and these attitudes are more favourable towards clearcutting for foresters located in 'clearcutting' States.

Thus, foresters in 'clearcutting' States appear to have attitudes consistent with the silvicultural practices of those States, while 'non-clearcutting' foresters are generally less favourable, and show greater diversity in attitude scores than 'clearcutting' foresters (Figure 6.1).

Thus attitude-activity consistency has occurred among 'clearcutting' foresters, and their group attitude differs from that of the 'non-clearcutting' foresters.

CHAPTER 7

THE EFFECT OF SOCIAL ENVIRONMENT II
MEMBERSHIP OF CONSERVATION ORGANIZATIONS -
Interactions with 'Other Social Arenas

This Chapter deals with the independent variable arising from the effects of interactions of the forestry social organization with other social arenas (Table 4.2) as expressed by membership of conservation organizations.

Social interactions of foresters who are members of conservation organizations with other members of those organizations might be expected to result in a degree of similarity in the attitudes of the foresters and the other members. Foresters who are members of conservation organizations have more opportunities for discussing environmental ideologies and practices, thus increasing their social interactions with fellow members of such organizations, than would foresters who belong only to the Institute of Foresters.

Non-forester members of conservation organizations might be expected to be more environmentalist in their views about forestry than foresters in general. Because of this, they might be expected to display at least less support, if not opposition, towards forestry operations such as clearcutting.

Foresters who are members of conservation organizations are likely to be involved in forestry in some way, thus they might be expected to be less extreme than other members of conservation organizations, although more 'environmentally' oriented than foresters who are not members of conservation organizations. Data were not collected to test, however, whether foresters who are members of conservation organizations are less extreme than others in such organizations with respect to forestry operations such as clearcutting.

Foresters were asked to indicate whether they belonged to any conservation organization or similar organization other than the Institute.[1] Those who indicated they were members of conservation organizations formed the group 'members', and, the other foresters the group 'non-members'. Foresters' responses to questionnaire items were again used as attitudes in the form of attitude scale scores.

THE EFFECT OF MEMBERSHIP OF CONSERVATION ORGANIZATIONS

Data to test the hypothesis that membership of conservation organizations is associated with less

1 While the Institute of Foresters can legitimately refer to itself as a conservation organization, it is not conventionally seen as part of the environmental movement. Thus where reference is made to conservation organizations this does not include the IFA.

favourable attitudes towards clearcutting among foresters were analysed using a multiple analysis of variance. These results are shown in Table 7.1. As previously, the scale means and scale standard deviations are in z score format, while the item means are shown as raw scores. The correspondence between item means and response categories is shown in Chapters 4 and 6.

The multivariate F test confirms that membership of conservation organizations has an effect on foresters' responses on the range of issues involved. The univariate F tests show that foresters who are members of conservation organizations have significantly higher levels of agreement with items than do foresters belonging only to the Institute of Foresters.

In Table 7.1, all scores for members of both the IFA and conservation organizations are higher than those for 'non-members' (IFA members only). However, if we examine the level of agreement to items for both groups, it is apparent that foresters who are members of conservation organizations do not necessarily agree that clearcutting has serious effects in all situations.

On the cognitive scales the item means of both groups show they agree that landscape effects (AMBIA scale) are more than somewhat probable. However, for the HYDROL (hydrological effects) scale, members of conservation organizations are more likely to agree that these effects are probable than the non-members (x_m = 0.54; x_{nm} = 0.50). Both groups disagree that ecological effects (ECOL scale) and nutrient effects (NUTRIN scale) are probable (x_m = 0.37, 0.34; x_{nm} = 0.34, 0.33) respectively for the two scales.[1] Nevertheless, these groups differ significantly in their level of agreement.

On the affective scales, both groups disagree with items that effects are serious, with such means being between the categories of 'not much' to 'somewhat' serious. Nonetheless, the groups differ significantly on all three scales.

The level of agreement on the conative scales is generally higher than on the other scales for both 'members' and 'non-members'. Thus, although both groups disagreed with items that effects are serious, they both believe that environmental protection could be improved. Thus, on the REGSTR scale, 'members' agree 'a lot' that regeneration protection could be improved, while both 'members' and 'non-members' agree with items that wildlife protection should be improved 'a lot'. There is, however, only one scale on which 'members' of conservation organizations and 'non-members' do not differ significantly, PSTSTR.

The scale means are shown transformed to positive numbers in Figure 7.1. This figure illustrates

1 x_m = item mean of 'member' group
x_{nm} = item mean of 'non-member' group

TABLE 7.1

The effect of membership of conservation organizations on attitudes, MANOVA

ATTITUDE SCALES	'Member' Scale mean	SD	Item mean	'Non-member' Scale mean	SD	Item mean	Univariate tests F-test	P
Cognitive								
AMBIA	0.32	0.80	0.55	-0.08	0.82	0.52	29.36	xx
HYDROL	0.35	0.99	0.54	-0.09	0.93	0.50	25.40	xx
ECOL	0.23	0.82	0.37	-0.06	0.74	0.34	17.02	xx
NUTRIN	0.24	0.85	0.34	-0.06	0.74	0.33	18.45	xx
Affective								
ECOEFF	0.37	1.17	2.64	-0.09	1.04	2.56	24.76	xx
HYDEFF	0.23	0.96	2.50	-0.06	0.95	2.41	10.73	xx
LANDSC	0.19	0.86	2.37	-0.05	0.83	2.32	8.81	xx
Conative								
HYDSTR	0.23	0.85	3.36	-0.06	0.81	3.25	13.41	xx
SILSTR	0.13	0.65	2.96	-0.03	0.63	2.93	8.09	xx
REGSTR	0.20	0.58	4.01	-0.05	0.68	3.90	15.30	xx
WLDSTR	0.23	0.70	3.72	-0.06	0.74	3.71	16.52	xx
PSTSTR	0.03	0.86	2.89	-0.01	0.82	2.88	0.16	NS
LNDSTR	0.16	0.80	3.31	-0.04	0.86	3.15	6.12	xx
N		140			560			

Multivariate test of significance F = 4.41 xx $p < .05$

Univariate df = 1690

Item means - see Table 6.1

and

corresponding

category

that the divergence of the two groups around the overall mean differs from the comparison of 'clearcutting' and 'non-clearcutting' States (Figure 6.1).

The means for the 'members' group seem to be pushed further away from the total sample mean, indicating that perhaps these foresters form a distinct group within the profession. The analysis presented in Table 7.1 certainly suggests that there are different attitudes among forester members of conservation organizations and other Institute members in general. These analyses also confirm that foresters who belong to these organizations appear to be rather less supportive of clearcutting operations than other foresters.

Figure 6.1 shows there is diversity in the responses of foresters in both 'clearcutting' and 'non-clearcutting' States. However, the range of responses is greater among foresters from 'non-clearcutting' States. In Figure 7.1 it is apparent there is little diversity in the responses of the forester 'non-members' compared with the forester 'members'. This suggests that part of the variation in the 'clearcutting' group responses (Figure 6.1) could be explained by the wider range of attitudes among the forester 'members' of conservation organizations who reside in those States. This will be examined in a later chapter.

The wider range of responses among foresters from the 'non-clearcutting' States might also be

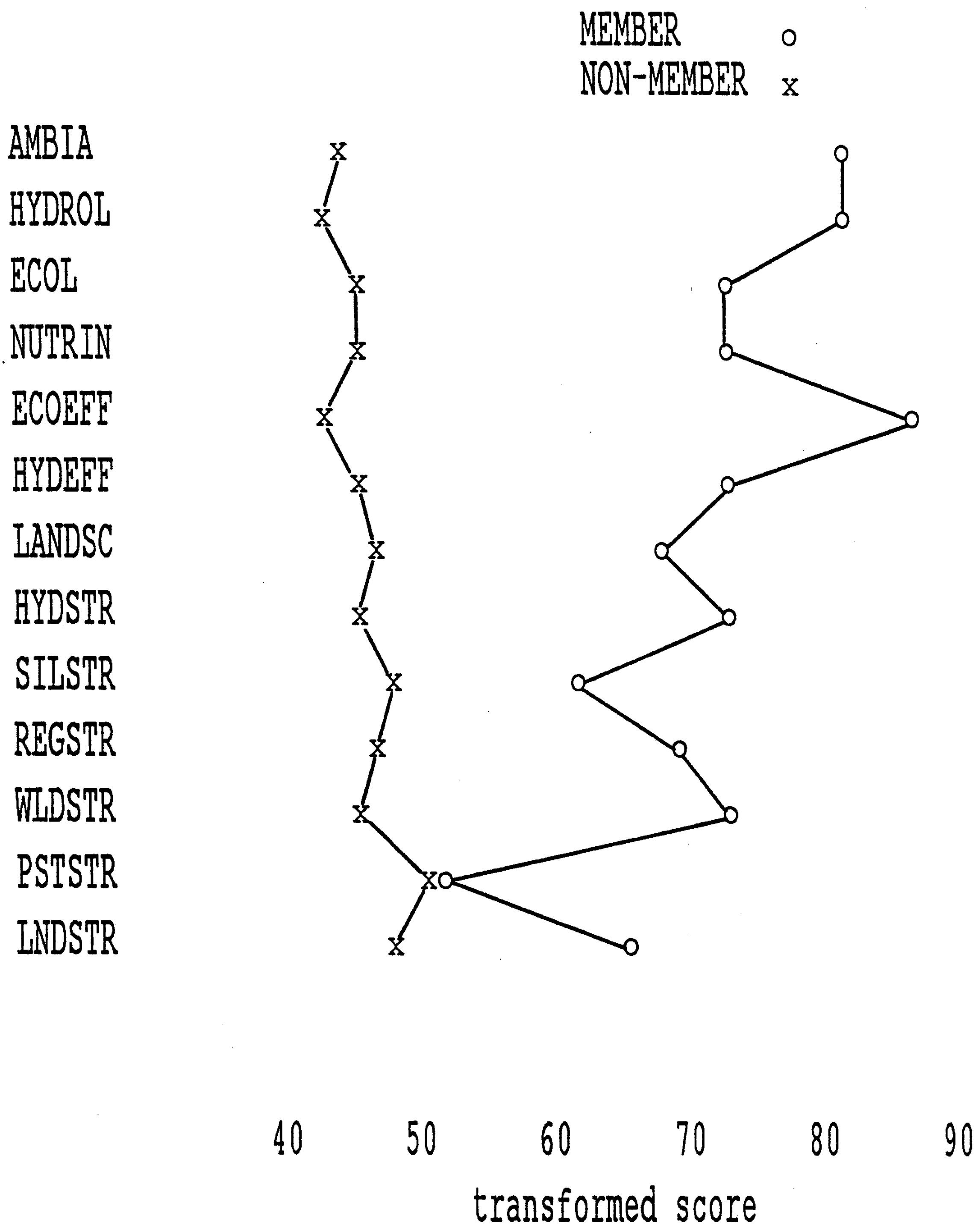

FIGURE 7.1

ATTITUDE VARIATION WITH MEMBERSHIP
OF CONSERVATION ORGANIZATIONS

explained partly by the presence of forester 'members' of conservation organizations in those States. However, the effect of State of residence is stronger than the effect of membership of conservation organizations, as a comparison of the multivariate F ratios indicate (Tables 6.1 and 7.1).

CROSS LOYALTIES

Some foresters participate in the activities of both a 'clearcutting' and a 'conservation organization' social environment. Such a situation could generate divided loyalties. The percentage of foresters who could be affected is shown in table 7.2 for the 'clearcutting' and 'non-clearcutting' States.

TABLE 7.2

Distribution of members of other conservation organizations among 'clearcutting' and 'non-clearcutting' States

GROUP	Percent 'members'	'non-members'
'Clear-cutting'	19.0	80.6
'Non-clearcutting'	21.2	78.8

Chi^2 = 1.23; not significant
Figures indicate row percentages

Table 7.2 illustrates an interesting phenomenon. There is a similar percentage of members of conservation organizations within the 'clearcutting' States and the 'non-clearcutting' States.

Thus, differences in attitudes between 'clearcutting' and 'non-clearcutting' foresters cannot be attributed largely to a concentration of 'environmentalist' foresters in 'non-clearcutting' States, but rather to the effects of presence in the social environment of a particular forestry 'culture'.

INTERACTION EFFECTS

The question that needs to be answered regarding the potential effects of both social environments is whether State location and 'membership' interact or have an additive effect. Nadel (1957) suggests that when different loyalties are demanded in different social situations, such as would occur for 'clearcutting' foresters belonging to conservation organizations, the attitudes of such persons might be more neutral than for those who are not faced with such situations. Berelson et al (1954) found cross pressure reduced the intensity of opinions about various issues.

Thus, we might expect to find foresters who are resident in 'clearcutting' States and also 'members' of conservation organizations somewhat less supportive of clearcutting than their colleagues who are not 'members'. If this were the case, we would expect the effects of State location and 'membership' to be additive. As was shown in Table 6.1, State location generated less agreement with items among 'clearcutting' foresters, while in Table 7.1, 'membership' generated more agreement with items, i.e. these two factors had an opposite effect on foresters' responses. Thus, a 'moderation' in attitudes would arise if these effects were additive, producing more neutral attitudes.

To determine whether in fact, this was the case, the multivariate F test for interaction between State of residence and 'membership' can be used.

The multivariate F test for the interaction term in such an analysis is 1.69, which is not significant at $p = .05$; we can reject the proposition that State location and membership interact. Thus, we would expect foresters who are 'members' and residents of 'clearcutting' States to be somewhat less favourable towards clearcutting than foresters in 'clearcutting' States who are not 'members'.

MODERATION IN ATTITUDES

In order to determine whether foresters in 'cross loyalty' situations have more moderate attitudes towards clearcutting than their colleagues; i.e. they are less supportive of clearcutting, it is necessary to examine the mean scores for 'members' and 'non-members' of conservation organizations in the 'clearcutting' States. We know from previous analyses that 'members'

TABLE 7.3

The effect of membership of conservation organizations among 'clearcutting' foresters: CROSS LOYALTY SITUATION

SCALE	MEMBER scale mean	NON-MEMBER scale mean	t	p
Cognitive				
AMBIA	0.24	-0.16	4.48	**
HYDROL	0.13	-0.20	3.14	**
ECOL	0.16	-0.15	3.73	**
NUTRIN	0.06	-0.18	3.13	**
Affective				
ECOEFF	0.09	-0.20	2.50	**
HYDEFF	-0.03[1]	-0.19	1.49	ns
LANDSC	0.04	-0.04	0.95	ns
Conative				
LNDSTR	0.14	-0.01	1.59	ns
REGSTR	0.14	-0.09	3.11	**
WLDSTR	0.14	-0.18	2.62	**
PSTSTR	-0.13[1]	-0.08	-0.57	ns
SILSTR	-0.04[1]	-0.15	1.66	*
HYDSTR	0.05	-0.14	2.19	**

1 Both groups can have negative means in this comparison as these are relative to the total sample mean. The scores of the 'non-clearcutting' State foresters are positive and are not accounted for in this table.

* $p < .10$; ** $p < .05$; ns not significant

are less supportive of clearcutting, but do not know how much less supportive 'members' are among 'foresters from 'clearcutting' States.

These data are shown in Table 7.3. The effect of membership is apparent within 'clearcutting' States. This result confirms the ANOVA for the overall effect of membership. The data are presented in Table 7.3 to confirm that 'cross loyalty' situations have produced moderated attitudes. Less favourable attitudes are shown by more positive scale means, indicating responses of greater agreement that effects are probable, or serious, or that protection is inadequate.

For the cognitive scales, the subgroup of 'members' among the 'clearcutting' States shows less favourable attitudes because of greater agreement with items (more positive scale means) for all scales. A comparison of Tables 6.1 and 7.3 shows that the 'members' among the 'clearcutting' States are still more favourable towards clearcutting than are the foresters in the 'non-clearcutting' States. However, the beliefs of 'members' about the effects of clearcutting are more moderate than those of 'non-members' among 'clearcutting' States. For the affective scales, the 'members' subgroup also exhibit more positive scale means and thus less favourable attitudes, but do not differ statistically on the HYDEFF and LANDSC scales.

There are five scales of the conative set on which the 'members' sub-group has more positive scale means, but on the PSTSTR scale, the members disagree that greater protection is needed for pests and disease, and have a more negative scale mean than the 'non-members'. However, there is no statistical difference on this scale. Thus, the members among 'clearcutting' foresters are more willing to accept the need for improved protection of the forest, and are overall less favourable in their attitudes towards clearcutting.

An explanation for such moderation can be found from application of the social model proposed in Chapter 3 which suggests that social environments would affect attitudes. The analyses of this chapter have illustrated one way in which the social environments in which foresters participate have affected their attitudes. While presence in a 'clearcutting' State led to less agreement with items, and membership of conservation organizations led to greater agreement with items, when foresters participate in both environments, the opposing effects of these environments has led to a moderation in attitudes. Thus, interactions within the conservation movement lead foresters to believe that clearcutting has undesirable effects on the forest, while at the same time, social interactions with other 'clearcutting' foresters tend to influence them towards the belief that clearcutting has minimal undesirable effects. The overall result on foresters' attitudes appears to be an additive effect of participation in both social environments. The effect of membership of conservation organizations is to shift the level of agreement more to the unfavourable side of the scale, although it has not brought agreement to the same level as that of 'non-clearcutting' foresters.

SUMMARY

This chapter suggests that social experience can affect attitudes. Fazio and Zanna (1978) show that direct experience with some issue or activity produces more consistent and pronounced attitudes towards those issues or activities. This effect will be addressed further in the following chapter.

The analyses of chapters 6 and 7, however, illustrate that social experience obtained by one's physical location in a particular territory, or membership in conservation organizations can generate social conditions among members of the social group leading to attitudes consistent with support for activities accepted or important to the group. Thus, attitude-activity consistency also appears to arise among social groups as well as among individuals as suggested by Festinger (1957) and others.

These results suggest that people, such as foresters, can be unwittingly affected by their social experience. In this case, a segregation of foresters' attitudes has occurred depending on the particular social experiences they might encounter in their working activities. This potential for generating substantially different attitudes poses a problem for consensus and communication between people of different social groups. Amongst foresters in Australia, this means there is an inherent tendency for conflict to arise, simply because of differences in attitudes to fundamental forestry practices based on differences in State of residence, or membership of conservation organizations.

Attitudinal bias in decision making has been well documented by Janis (1982) and provides a warning that policy makers may fall into attitudinal traps, ignoring available objective information, the opinions of interested parties, or even the characteristics present in the actual situation.

Twight (1983) documents what happened within the U.S. Forest Service because of attitudinal bias to land use policy. These effects need to be remembered by those responsible for making or changing policies, as Ajzen (1982) shows that attitudes to specific activities are very strong predictors of what people actually do in relation to those activities.

Foresters have a social responsibility to generate policies and make decisions consistent with sound ecological principles, and within an objective frame of reference. They should not be victims of a subjective attitudinal aura which colours rational assessment.

In the next chapter we look at direct social experience as a factor that may produce attitude bias and change in foresters.

CHAPTER 8

THE EFFECT OF SOCIAL ENVIRONMENT III - Direct Interactions with the Forest Environment

This Chapter addresses the independent variable arising from the interactions of the forestry social organization and the forest (Table 4.2) in the form of direct experience of clearcutting operations.

Social psychology theory suggests a tendency for consistency between attitudes and behaviour. When engaging in a particular activity, such as might be required in one's employment, a person's attitude towards that activity might change in order to avoid the tension resulting from attitudes inconsistent with one's activities. A person could also avoid such tension, by changing employment.

Foresters' attitudes towards particular forestry activities might also change if they become involved in them.

As foresters become more directly involved in a particular forestry activity and in social interactions surrounding such activities, they would be drawn into the social domain and interests of the group; and their attitudes tending towards those most common within the social group. Thus, foresters who are, or become involved in clearcutting operations, might acquire the attitudes of those already involved, and support those activities more strongly than those who are not.

This chapter addresses the possibility that direct experience in clearcutting operations affects foresters' attitudes towards clearcutting. There are two potential sources for obtaining direct experience of clearcutting. These are in the supervision of field operations, and in the management area associated with planning forestry operations.

In order for foresters' attitudes to be consistent with their involvement in clearcutting, we might expect those who have direct field or management experience of clearcutting to support it or at least be more supportive than those who have not had such experience.

These propositions can be tested by examining the hypotheses:

H1: That field experience leads to less agreement with the propositions that clearcutting has effects on the forest, or that these effects are serious, and less agreement that environmental protection strategies are inadequate.

H2: That management experience in clearcutting leads to less agreement with the propositions that clearcutting has effects on the forest, or that these effects are serious, and less agreement that environmental protection strategies are inadequate.

DIRECT FIELD EXPERIENCE OF CLEARCUTTING

Foresters were grouped according to their response to the question "Have you had any field experience with clearcutting operations in native eucalypt forest?" Those who answered yes constitute the 'field experience' group and the others the 'no field experience' group.

In order to test the hypotheses above a multiple analysis of variance was undertaken, using the cognitive, affective and conative scales described in Chapter 5 and Appendix E.

As in previous analyses (Chapters 6 and 7) the means shown in Table 8.1 are z scores, such that negative means represent scores below the overall mean, while positive means indicate scores above the overall mean. Raw score item means are also shown for each scale, indicating the mean level of agreement with items on each scale.

The multivariate test of significance, F=8.54 (Table 8.1) shows that direct field experience has an effect on the attitude scores of foresters. When each scale is tested separately, there is a significant difference on 9 out of 13 scales.

When State of location was examined in Chapter 6, there were three scales on which no difference in scores was apparent. Two of these scales, LANDSC and LNDSTR also appear in Table 8.1 with no major difference. This suggests that foresters as a whole may have similar beliefs about the effects of clearcutting on landscapes, and about strategies to improve landscape values. The level of concern for landscape effects (LANDSC) does suggest some potential for conflict with groups concerned about the visual impacts of clearcutting.

As for foresters in 'clearcutting' States (Chapter 6), foresters with field experience are significantly more committed to clearcutting; SILSTR scores being 2.14 item mean for field experience and 3.04 for no field experience, with F=48.45 (Table 8.1). These item means show disagreement with items by those with field experience compared with agreement to items by those without field experience. This was the same difference noted in Table 6.1 for State of location.

Thus, field experience in clearcutting or location in a clearcutting State both generate attitudes favourable towards clearcutting activities.

Foresters without field experience are also significantly more concerned about the seriousness of hydrological effects (HYDEFF) than those with such experience, $F = 51.94$; $p < .01$. However, both groups have responded in a manner suggesting general disagreement with the proposition that clearcutting has major hydrological effects.

It appears from the range of scale means that the 'no field experience' foresters have more varied attitudes towards the various issues concerned than the 'field experience' foresters. The range for 'no field experience' being 0.38 standard deviation units compared with 0.18 standard deviation units for the 'field

TABLE 8.1

The effect of direct field experience

MANOVA

ATTITUDE SCALE	NO FIELD EXPERIENCE SCALE MEAN	SD	ITEM MEAN	FIELD EXPERIENCE SCALE MEAN	SD	ITEM MEAN	UNIVARIATE F	P
AMBIA	0.08	0.84	0.54	-0.04	0.82	0.53	2.19	ns
HYDROL	0.25	0.96	0.53	-0.12	0.93	0.49	19.70	xx
ECOL	0.21	0.73	0.37	-0.10	0.76	0.34	21.03	xx
NUTRIN	0.28	0.82	0.35	-0.13	0.72	0.32	38.09	xx
ECOEFF	0.42	1.08	2.66	-0.20	1.02	2.54	39.05	xx
HYDEFF	0.40	0.92	2.55	-0.19	0.92	2.37	51.94	xx
LANDSC	0.09	0.90	2.35	-0.05	0.80	2.32	3.10	ns
HYDSTR	0.25	0.77	3.37	-0.12	0.83	3.22	30.41	xx
LNDSTR	0.02	0.88	3.20	-0.01	0.84	3.17	0.06	ns
SILSTR	0.23	0.56	3.03	-0.11	0.64	2.92	48.45	xx
WLDSTR	0.11	0.74	3.71	-0.06	0.74	3.70	5.72	xx
PSTSTR	0.21	0.83	2.93	-0.10	0.81	2.85	24.51	xx
REGSTR	0.04	0.64	3.94	-0.02	0.68	3.91	1.33	ns
N		230			468			

Multivariate test of significance $F = 8.54$; df 856; xx $p < .01$

univariate df = 1675

scale raw scores

cognitive	affective/conative	level of agreement
0.010	1	not at all
0.245	2	not much
0.490	3	somewhat
0.735	4	a lot
0.990	5	total agreement

experience' foresters. The 'no field experience' group seems to be more distinctly different as a group from the 'field experience' foresters, whose scores are much more uniform and close to the overall scale means for the total respondent sample.

This effect is more apparent if the scale means are transformed and plotted as in Figure 8.1. Again the scores were transformed such that all scores were positive (TSCORE = (SCORE * 100) + 50).

These plotted scores show relative differences between the two groups when compared with the actual mean of each scale, here represented as a score of 50.

The smaller variation in scale means over all attitude scales for the 'field experience' foresters suggests more conformity in attitude towards clearcutting as it affects different forest elements compared with 'no field experience' foresters.

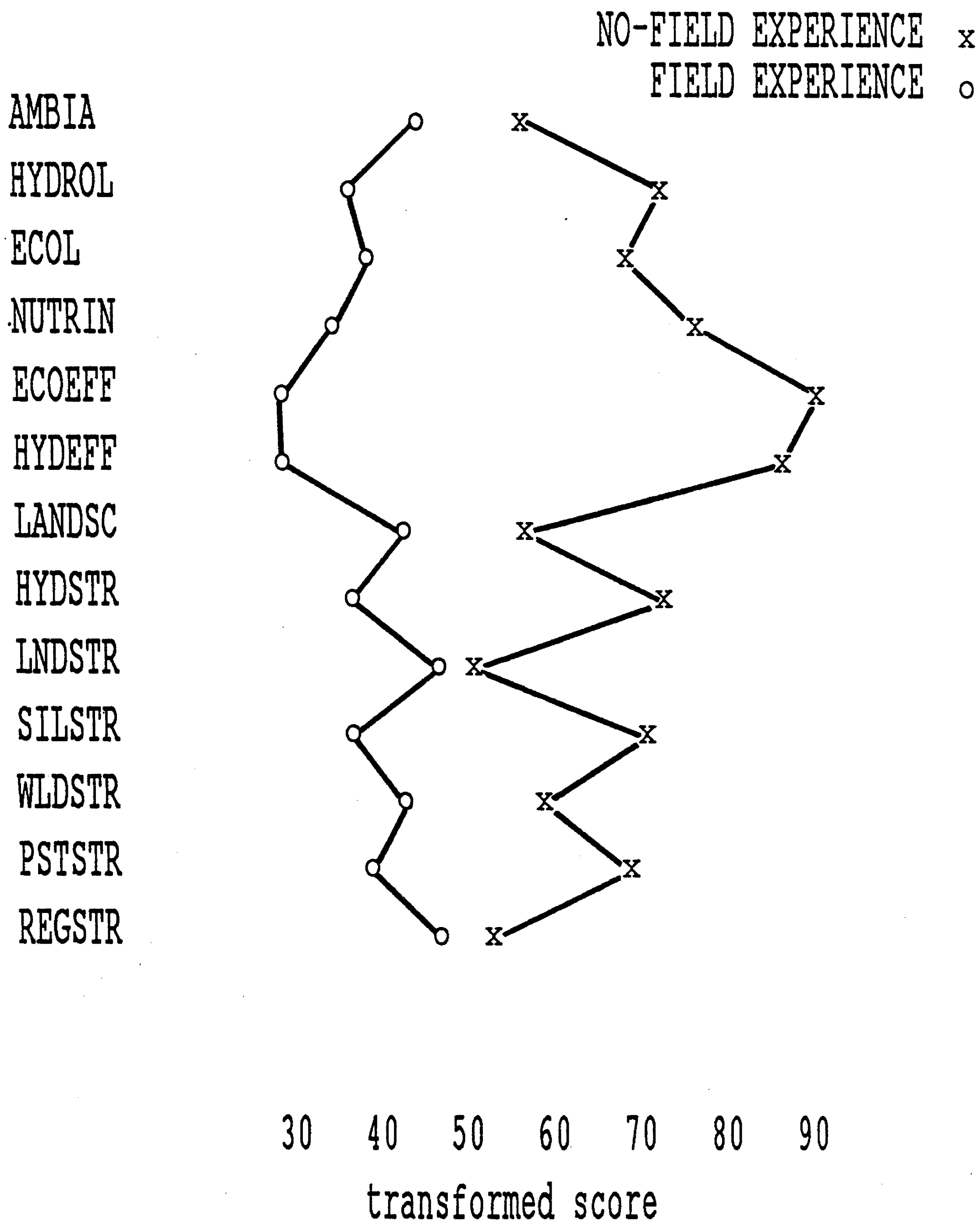

FIGURE 8.1

ATTITUDE VARIATION WITH FIELD EXPERIENCE

INTERACTION EFFECTS

In order to be sure that field experience of clearcutting has an independent effect from State of location, it is necessary to test for interaction effects between STATE and FIELD EXPERIENCE. This effect can be included in the MANOVA model, which is the case here. For the multivariate test of significance for STATE by FIELD EXPERIENCE, $F = 1.06$, which is not significant.

The univariate tests for the interaction effect were also not significant except for HYDSTR, where $F = 8.97$, $p < .01$. From these two tests we can conclude that there is no significant interaction between State of residence and field experience. Thus, State of residence and direct field experience have an independent effect on responses to questionnaire items. Field experience thus has the same effect on foresters in 'non-clearcutting' and 'clearcutting' States.

Foresters with field experience may be less likely to become members of conservation organizations; and thus becoming more entrenched in their attitudes towards clearcutting. However, when we examine the distribution of 'members' among foresters with and without field experience, we find no significant difference in the proportions of foresters who are 'members' among the 'experience' groups (Table 8.2).

A multivariate test for the interaction of membership of conservation organizations and field experience produced $F = 1.26$, which is not significant.

Thus, the three factors, State of location, field experience and membership of conservation organizations each have an independent effect. Residence in a 'clearcutting' State and field experience reduce the scores of foresters, while membership of conservation organizations increases scores.

TABLE 8.2

The distribution of members of conservation organizations among foresters with and without field experience

	PERCENT		
Member	Field experience	No field experience	
Member conservation organizations	19.7 (6.4)	20.0 (13.6)	(20)
Member IFA only	80.3 (26.6)	80.0 (53.4)	(80)
$Chi^2 = 0.02$ ns	(33.0)	(67.0)	

Figures in brackets indicate percentage of all respondents in table cell
Unbracketed figures indicate column percentages

Thus, we might expect foresters who work in a 'clearcutting' State, who have field experience, and who do not belong to a conservation organization to be the most supportive of clearcutting activities on the basis of the factors thus far examined. The relative importance of these factors will be examined later in the chapter using a multiple regression analysis.

Sawyer (1982) also found that experience as a water supply manager had led such managers to particular attitudes supporting the activities they were involved in. This effect is apparent among Australian foresters with field experience in clearcutting.

As not all foresters with such field experience remain in a 'clearcutting' State (Table 8.3) the results seem to suggest that past involvement in some activity maintains a degree of commitment to the activity even after direct involvement ends.

Thus, it seems that direct experience of a particular activity leads to views about that activity tending to justify or rationalise it, by generating attitudes consistent with the validity or carrying out of such activity.

TABLE 8.3

Field experience in clearcutting operations: 'clearcutting' and 'non-clearcutting' 'territories'

	PERCENT OF FORESTERS	
:RRITORY GROUP	FIELD EXPERIENCE	NO FIELD EXPERIENCE
:LEARCUTTING"	80.0	19.2
NON-CLEARCUTTING"	35.1	64.9

hi^2 = 139.1, $p < .001$
igures indicate row percentages

MANAGEMENT EXPERIENCE OF CLEARCUTTING

We now turn to the effect of management experience with clearcutting operations on foresters' attitudes.

Foresters were asked to indicate whether they had:

1) No management experience;
2) one to five years management experience;
3) six to ten years management experience; or
4) more than ten years management experience.

Foresters' responses to this question are summarised in Table 8.4. Approximately half the Institute members have had some management experience with clearcutting. For most this is between one to five years.

TABLE 8.4

The distribution of management experience

YEARS EXPERIENCE	PERCENT OF FORESTERS
None	45.9
1 to 5	27.6
6 to 10	11.7
More than 10	14.5

Foresters who have had no management experience are evenly divided between the 'clearcutting' and 'non-clearcutting' States (Table 8.5). However, among 'non-clearcutting' foresters, 77.4 percent have had no management experience, while 67.0 percent of 'clearcutting' foresters have had at least one year of such experience. This might suggest that foresters have not tended to move from 'clearcutting' to 'non-clearcutting' States to any great extent.

A summary of the scale and item means for each of the management experience groups is shown in Table 8.6. The variation in means is illustrated with transformed scores in Figure 8.2 (mean = 100). In order to determine whether management experience has had an effect on foresters' attitude scores, a MANOVA model was used. The results of such an analysis are shown in Table 8.7.

The multivariate F test ($p < .01$) indicates that membership in one of the management experience groups has an effect on attitude. All univariate tests are significant except for the LNDSTR and REGSTR scales. The data in Table 8.6 suggests that attitudes become more favourable towards clearcutting (increasing negative scale means) with increasing management experience.

TABLE 8.5

The distribution of management experience among the 'clearcutting' and 'non-Clearcutting' States

STATE GROUP	PERCENT OF FORESTERS			
	None	1 to 5 years	6 to 10 years	more than 10
'CLEARCUTTING' STATES	32.6 (50.0)	33.6 (85.6)	15.2 (91.5)	18.2 (88.2)
'NON-CLEARCUTTING" STATES	77.4 (50.0)	13.5 (14.4)	3.4 (8.5)	5.8 (11.8)
TOTAL INSTITUTE SAMPLE	45.9	27.6	11.7	14.5

NOTES: Figures in brackets refer to the proportion of each 'experience' group within either the 'clearcutting' or 'non-clearcutting' groups.

$CHI^2 = 119.52; \quad p < .01$

TABLE 8.6

Variation in attitude scores with management experience

SCALE	None			1 to 5 years			6 to 10 years			more than 10 years		
	Scale mean	SD	item mean	Scale mean	SD	item mean	Scale mean	SD	item mean	Scale mean	SD	item mean
AMBIA	0.11	0.82	0.54	0.02	0.83	0.53	-0.04	0.83	0.527	-0.34	0.75	0.51
HYDROL	0.24	0.93	0.53	-0.12	0.94	0.49	-0.18	0.89	0.489	-0.40	0.91	0.47
ECOL	0.17	0.75	0.36	-0.09	0.79	0.34	-0.08	0.69	0.34	-0.31	0.70	0.32
NUTRIN	0.26	0.82	0.34	-0.13	0.70	0.32	-0.27	0.66	0.31	-0.37	0.56	0.307
ECOEFF	0.41	1.06	2.65	-0.07	1.04	2.57	-0.36	0.87	2.52	-0.88	0.68	2.43
HYDEFF	0.37	0.91	2.54	-0.15	0.90	2.38	-0.25	0.89	2.35	-0.70	0.73	2.21
LANDSC	0.10	0.89	2.35	-0.01	0.80	2.33	-0.05	0.80	2.32	-0.29	0.68	2.27
HYDSTR	0.23	0.78	3.36	-0.14	0.77	3.21	-0.20	0.83	3.19	-0.31	0.88	3.15
LNDSTR	0.04	0.84	3.21	0.01	0.79	3.29	-0.09	0.93	3.10	-0.10	0.90	3.097
PSTSTR	0.17	0.81	2.72	-0.20	0.77	3.19	-0.09	0.79	2.86	-0.09	0.90	2.86
SILSTR	0.19	0.59	2.98	-0.10	0.62	2.92	-0.02	0.64	2.915			
REGSTR	0.06	0.64	3.93	-0.02	0.73	3.88	-0.09	0.72	3.71	-0.06	0.63	2.88
WLDSTR	0.10	0.72	2.713	-0.02	0.74	3.609	-0.22	0.78	3.603	-0.22	0.78	3.70

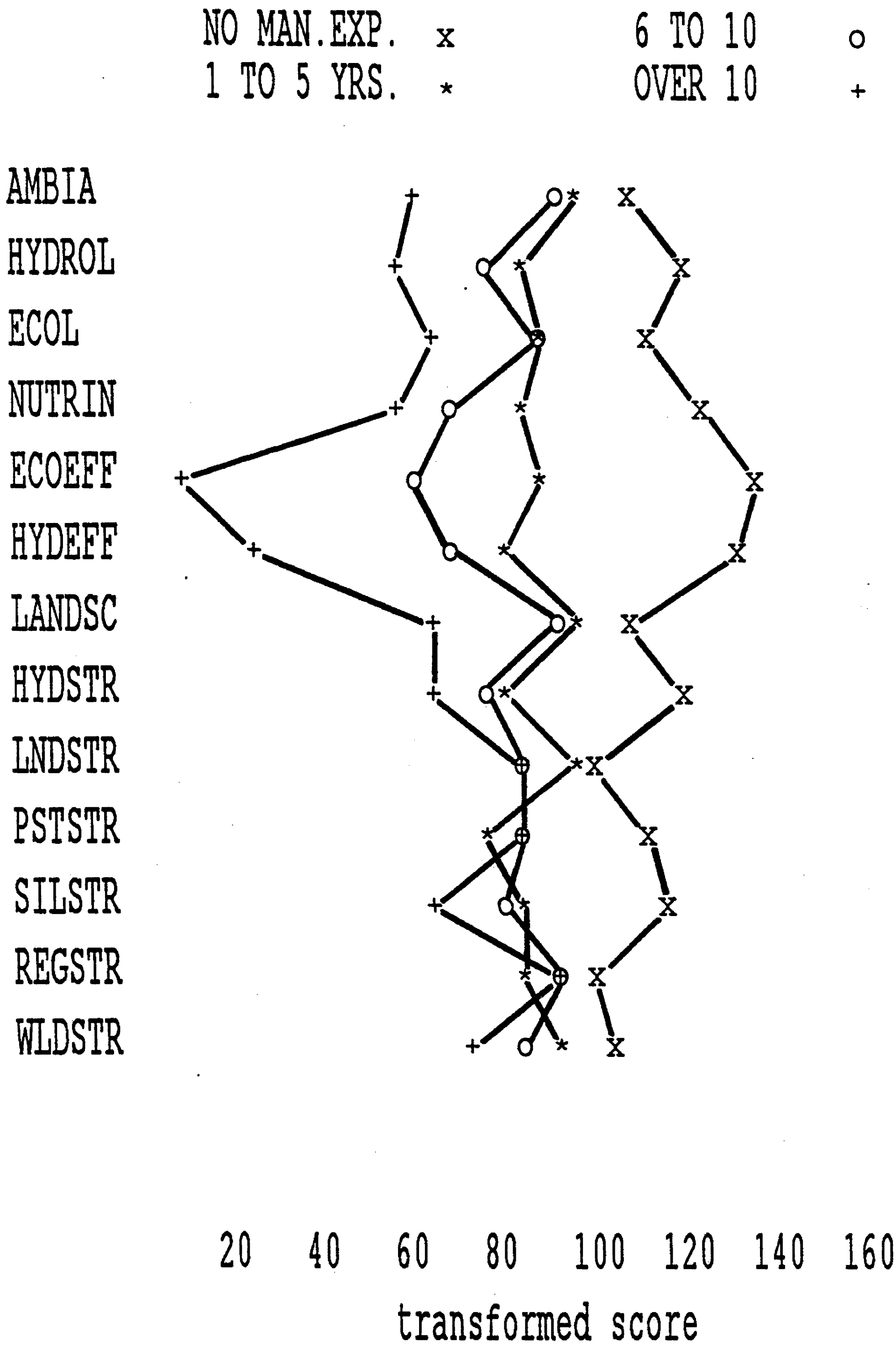

FIGURE 8.2

ATTITUDE VARIATION WITH MANAGEMENT EXPERIENCE

<u>TABLE 8.7</u>

MANOVA for the effect of management experience

Multivariate F = 4.21; $p<0.01$

Univariate tests df = 3,675

SCALE	F	P
Cognitive		
AMBIA	6.68	xx
HYDROL	11.34	xx
ECOL	7.88	xx
NUTRIN	17.55	xx
Affective		
ECOEFF	21.85	xx
HYDEFF	27.21	xx
LANDSC	4.12	xx
Conative		
SILSTR	23.51	xx
HYDSTR	13.71	xx
LNDSTR	0.51	ns
PSTSTR	8.98	xx
WLDSTR	2.56	xx
REGSTR	1.46	ns

xx $p<.05$

ns not significant

INTERACTION EFFECTS

It is necessary to test for interaction between the effect of management experience of clearcutting and other effects, to ensure the effects are independent. The interaction of territory and management experience of clearcutting, and field and management experience are particularly important. Membership of conservation organizations may be less important because of the small number (about 20 percent) who are members, and the spread of these members among the four groups. However, if there is significant interaction this needs to be noted.

For the case of territory ('clearcutting' or 'non-clearcutting') and management experience of clearcutting, the multivariate test of significance for interaction is $F=0.98$, and is not significant at $p<.05$. For univariate tests of interaction, one scale (HYDSTR) shows significant interaction effects, $F = 3.73$. This shows the effects of territory and management experience of clearcutting do not interact to any great extent, and that management experience of clearcutting has had similar effects on foresters' responses in both 'clearcutting' and 'non-clearcutting' States. Thus, for foresters in 'clearcutting' and 'non-clearcutting' States, increasing management experience has lead to decreased agreement with items, and correspondingly more favourable attitudes towards clearcutting.

When we examine interaction between field and management experience, there is evidence for interactive effects. The multivariate F=1.90, is significant at $p < .05$. However, when we look at the univariate tests there are only three attitudes scales with significant interaction. These are: AMBIA: f=4.77, $p < .05$; HYDROL, F-=3.96, $p < .05$; and LNDSTR, F=2.93, $p < .05$. Although the multivariate test is significant, the interaction effect is specific to certain issues.

As there is interaction between the effects of field and management experience as this affects attitude scores, we need to look at the effects of field and management experience separately, with each of these effects already accounted for in the statistical model. These results appear in Table 8.8.

Both field and management experience can have a significant independent effect on attitudes towards clearcutting. Such independent effects would arise if foresters had either field or management experience. For those foresters who have both field and management experience, it is clear from Table 8.8 that the effect of management experience outweighs the effect of field experience. This is not unexpected; field experience relates to a simple YES/NO category variable, while management experience incorporates the effect of time.

For those foresters who have both field and management experience, management experience of clearcutting is the more important in affecting attitude scores. Thus, it is more useful to know how much

TABLE 8.8

The effects of field and management experience: MANOVA

ATTITUDE SCALE	EFFECT OF EXPERIENCE							
	FIELD EXPERIENCE				MANAGEMENT EXPERIENCE			
	ALONE		WITH MANAG. EXPERIENCE		ALONE		WITH FIELD EXPERIENCE	
	F	P	F	P	F	P	F	P
Cognitive								
AMBIA	3.35		0.74	ns	8.24	xxx	7.37	xxx
HYDROL	25.56	xxx	0.22	ns	16.03	xxx	7.58	xxx
ECOL	27.20	xxx	2.73	x	12.75	xxx	4.59	xxx
NUTRIN	50.28	xxx	1.00	ns	28.04	xxx	11.61	xxx
Affective								
ECOEFF	62.24	xxx	0.24	ns	50.50	xxx	29.83	xxx
HYDEFF	71.38	xxx	1.20	ns	45.81	xxx	22.42	xxx
LANDSC	4.44	xx	0.09	ns	5.91	xxx	4.46	xxx
Conative								
HYDSTR	35.43	xxx	1.33	ns	17.60	xxx	6.23	xxx
SILSTR	54.37	xxx	4.73	xx	24.88	xxx	8.33	xxx
PSTSTR	23.84	xxx	2.92	x	9.28	xxx	2.31	ns
LNDSTR	0.23	ns	0.66	ns	1.14	ns	1.29	ns
WLDSTR	8.52	xxx	0.24	ns	5.66	xxx	2.90	xx
REGSTR	1.32	ns	0.06	ns	1.72	ns	1.32	ns

x $p < .10$ xx $p < .05$ xxx $p < .01$ ns not significant management experience a forester has had rather than his or her field experience when assessing attitudes towards clearcutting.

THE COMBINED EFFECTS OF SOCIAL EXPERIENCE

It is worth examining the importance that each of the factors so far examined has on overall attitude scores. The effects of 'indirect' social experience, territory location and membership of conservation organizations were examined in chapters 6 and 7. This Chapter has examined the effects of 'direct' social experience, field and management experience.

Some interaction was found between field and management experience, so it is not possible to include both these as independent variables in a model including all effects. As Table 8.8 demonstrates, when field experience effects are accounted for, management experience still has a significant effect on attitude scores. (See Table 8.8 column labelled 'management experience with field experience'). Thus, management experience is preferable as a direct social experience variable to field experience. A multiple regression analysis is suitable for the current purposes using a standard stepwise procedure (Nie et al, 1981) and the general linear model (Neter and Wasserman, 1974). We would expect a linear relationship between the effects excluding field experience, as there was no interaction between them.

REGRESSION ANALYSIS

An analysis including territory, membership of conservation organizations and management experience is presented in Table 8.9. The significant F ratios for all regressions confirm a linear relationship exists between the effects. This suggests that attitudes are strengthened if foresters participate in more social situations involving particular types of forestry activities, or are excluded from social situations where alternative attitudes might be more prevalent.

Table 8.9 does not include regressions for all scales, but the least and most significant for the cognitive and affective dimensions, and the three significant scales for the conative dimension.

In two of the regressions shown there are only two significant effects. The effect of territory is not significant for the LANDSC or WLDSTR scales (Table 6.1) and thus does not appear in the regression solutions for those scales.

From Table 8.9, management experience has the most important relative effect on attitude scores. On only one scale (SILSTR) is this not the case. This suggests that direct social experience is a more important determinant of group attitudes than indirect. Thus result is consistent with Fazio and Zanna (1978) who suggest that direct experience reinforces attitudes and leads to more strongly held beliefs.

TABLE 8.9

Regression analysis - social environment and social experience combined for selected scales

SCALE	SIGNIFICANT EFFECTS	Beta	t	p	F	R^2
NUTRIN					38.69	14
	MANAG	-.25	-6.7	xx	Residuals	
	TERRITORY	.16	4.5	xx	approximately	
	MEMBER	.14	3.9	xx	normal over whole range	
ECOL					20.53	8
	MANAG	-.17	-4.3	xx	Residuals	
	MEMBER	.14	3.8	xx	approximately	
	TERRITORY	.13	3.3	xx	normal over whole range	
ECOEFF					59.05	20
	MANAG	-.38	-10.6	xx	Residuals	
	MEMBER	.16	4.7	xx	normal over	
	TERRITORY	.08	2.2	xx	whole range	
LANDSC					12.63	3
	MANAG	-.15	-4.0	xx	Residuals	
	MEMBER	.10	2.8	xx	approximately normal	
SILSTR					38.94	14
	TERRITORY	.24	6.3	xx	Residuals	
	MANAG	-.21	-5.6	xx	normal over	
	MEMBER	.08	2.4	xx	whole range	

TABLE 8.9 (contd.)

SCALE	SIGNIFICANT EFFECTS	Beta	t	p	F	R^2
HYDSTR					22.63	9
	MANAG	-.20	-5.22	xx	Residuals	
	MEMBER	.12	3.32	xx	normal	
	TERRITORY	.12	3.14	xx		
WLDSTR					16.53	4
	MANAG	-.15	-4.07	xx	Residuals	
	MEMBER	.14	3.89	xx	approximately normal	

Notes: Categories for independent variables were coded as follows:
<u>Management experience</u>: increasing experience, increasing category value.
<u>Territory</u>: clearcutting = 0; non-clearcutting = 1.
<u>Member conservation organizations</u>: non-member = 0; member = 1.
The higher the Beta value, the greater the importance of the variable in accounting for variance in scores.
The R^2 values are an indication of the variation in attitude scores amongst foresters. Those scales on which low values occur have only small differences in attitudes between the group.

In the case of SILSTR, direct experience is not the most important determinant of scores, but territory. This result is interesting since the scale contains the most contentious issues related to the silviculture of clearcutting (Appendix E), for example, alternative options to the use of clearcutting. Thus, if foresters are most committed to clearcutting, they would disagree most with the items on this scale.

In fact this has occurred. Table 6.1 shows the univariate F=77.38 for SILSTR, the highest value for all scales when territory is examined. Field experience also shows a very significant difference on this scale (Table 8.1). Similarly, the largest difference between foresters with various amounts of management experience occurs on the SILSTR scale among all the conative scales (Table 8.7).

As Table 8.9 shows, both territory and management experience are similar in the importance these effects have on determining attitude scores on the SILSTR scale. The positive beta coefficient for TERRITORY indicates higher agreement by foresters in 'non-clearcutting' States, while the negative beta coefficient for management experience indicates decreasing agreement with increasing experience.

These results confirm that acceptance of varying silvicultural regimes is very much dominated by where one practises forestry, and how much experience one has in the application of a particular silvicultural regime.

This suggests that attitudinal bias could be a very significant factor in determining the choices made about the silviculture applied to eucalypt forests, as well as the constraints that may be imposed because of biological, commercial or other factors.

PRECONCEIVED ATTITUDES TO CLEARCUTTING

In this chapter the effects of field or management experience, and the combined effects of social experience were analysed. We might wonder whether graduate foresters join particular forest services because they already accept the forestry practices carried out, or whether their attitudes arise from their work experience as suggested in this thesis.

In order to pass some judgement on this proposition, we need an assessment of the attitudes foresters may have held before they joined a forest service. Some indication of such attitudes may be found from responses to the questionnaire items by forestry students. A useful group for this purpose is final year forestry undergraduates who have not yet joined either a private or State forest agency.

FORESTRY STUDENTS AND FORESTERS

Two consecutive fourth year classes of the A.N.U. Forestry Department were given the questionnaire and their responses to items are shown in Table 8.10. It was not possible to calculate factor scores for the student sample, as it cannot be regarded as part of the population of Institute members used in the original factor analysis.

Table 8.10 also contains the foresters' responses to the items, and it is these scores that are compared with those of the students. Because of the large difference in sample size between the students and foresters, it would be pointless to attempt any statistical comparison. Nevertheless, the level of agreement and relative difference between students and foresters provides some indication of attitude differences that may exist.

For items in the cognitive set, all means of the student group have higher values than the forester group, indicating greater agreement that the postulated effects are probable. Similarly for items in the affective set, all means for the student group are higher than the forester group, indicating greater agreement that the postulated effects are serious. However, for items in the conative set, students agreed more that environmental protection strategies should be carried out on 16 out of the 20 items, while on the remaining 4 items, 'coupe location', 'identification of landscapes', 'care near streams' and 'increased supervision near streams', the forester group agreed that more needed to be done.

Thus, it appears that student foresters are more concerned about the effects of clearcutting than foresters in the Institute. We might therefore tentatively assume that the noted effects of experience in clearcutting operations have come about as a result of that experience, rather than a predisposition to supporting clearcutting activities.

TABLE 8.10

A comparison of students and foresters

ITEM	STUDENTS		FORESTERS	
COGNITIVE SET	MEAN	SD	MEAN	SD
reduction in settings	0.64	0.31	0.54	0.32
panoramic landscapes	0.56	0.30	0.47	0.25
micro landscapes	0.67	0.28	0.58	0.28
canopy dwellers pop	0.63	0.32	0.40	0.28
animal diversity	0.71	0.26	0.56	0.31
canopy birds	0.78	0.26	0.55	0.30
native species	0.72	0.27	0.63	0.28
plant diversity	0.70	0.26	0.39	0.31
disease susceptibility	0.58	0.24	0.26	0.21
long term species	0.53	0.25	0.41	0.30
flooding	0.54	0.28	0.41	0.28
stream sedimentation	0.66	0.27	0.53	0.28
erosion - stable soils	0.53	0.24	0.45	0.27
erosion - unstable soils	0.74	0.30	0.63	0.28
loss of nutrients	0.64	0.27	0.39	0.28
pests before regeneration	0.32	0.23	0.26	0.21
replacement of nutrients	0.70	0.28	0.34	0.28

Notes: scale equivalents

score	response
0.01	not at all probable
0.245	not much
0.49	somewhat
0.735	highly
0.990	very highly

TABLE 8.10 (continued)

ITEM AFFECTIVE SET	STUDENTS MEAN	 SD	FORESTERS MEAN	 SD
nutrient removal	3.44	0.70	2.62	0.99
soil movement	3.07	0.90	2.42	0.91
flooding	2.93	0.85	2.19	0.89
sedimentation	3.42	0.77	2.83	0.99
panoramic effects	2.88	0.89	2.31	0.86
micro effects	3.08	1.00	2.53	0.95
pests and diseases	2.73	0.94	2.07	0.87
plant/animal diversity	3.52	0.82	2.45	0.95
long term plant commun. changes	3.52	0.93	2.42	1.03
ecological stability	3.96	0.96	2.67	1.12
animal diversity	2.88	0.92	2.30	0.89
long term animal diversity	4.16	0.75	2.71	1.18
long term animal populations	3.63	0.82	2.50	1.08
long term habitat reduction	3.66	0.82	2.79	1.05
recreation opportunities	2.72	0.82	2.15	0.89
site nutrient capital	4.04	0.79	2.77	1.10

Notes: Scale equivalents

score	response
1	not at all serious
2	not very serious
3	somewhat
4	very serious
5	unacceptable

TABLE 8.10 (continued)

ITEM CONATIVE SET	STUDENTS MEAN	STUDENTS SD	FORESTERS MEAN	FORESTERS SD
coupe location	3.35	1.04	3.56	1.13
mechanical disturbance	4.13	0.90	2.91	1.22
check regeneration (pests)	3.45	0.98	3.07	1.18
pre-regeneration checks	3.33	1.03	2.70	1.15
animal surveys	4.39	0.69	3.68	1.09
specific planting	4.42	0.73	3.73	1.11
habitat	3.58	1.07	2.85	1.25
visual impacts	3.43	1.08	3.27	1.09
viewing limit	3.13	1.08	2.30	1.15
identify landscapes	3.88	0.83	3.96	0.99
extra planting	3.69	0.93	3.29	1.13
selection logging	4.31	0.75	3.21	1.26
survey regeneration	4.44	0.61	4.31	0.86
care near streams	3.79	0.98	3.86	1.12
supervision	3.77	0.91	4.04	1.00
water sampling	3.49	0.67	2.94	1.14
heavy machinery	3.52	0.96	3.18	1.12
monitor acquatic life	3.72	0.85	3.09	1.13
filter strip width	4.44	0.61	4.05	1.02
small coupes	3.59	1.02	2.79	1.39

Notes: scale equivalence level of agreement

score	response
1	not at all
2	not much
3	somewhat
4	a lot
5	totally agree

SUMMARY

Foresters' attitudes vary depending on their involvement with clearcutting operations. Those with field experience of clearcutting are generally more favourable towards it than those without. The longer foresters have had management experience in clearcutting, the more they disagree with questionnaire items. Thus, they become less convinced that clearcutting has effects on the forest; they become less convinced that these effects are serious; and less convinced that greater environmental protection is needed.

Differences between foresters with some clearcutting experience and others without, could create situations for conflict when alternative silvicultural strategies are proposed, or ought to be considered in particular situations.

The analyses presented in Table 8.9 show that foresters' attitudes towards clearcutting become more favourable if they live in a 'clearcutting' State and have had management experience. We would expect a range of attitudes towards clearcutting to occur among the members of the Institute of Foresters. This illustrates the fundamental weakness in studies such as described in Chapter 1, which assume a homogeneous attitude exists among foresters to forestry issues.

CHAPTER 9

THE EFFECT OF OCCUPATIONAL ACTIVITIES

This chapter examines the effect of organizational involvement on foresters' attitudes towards clearcutting. Foresters' professional activities are grouped into four functional groups, which are then used as the basis for examining variation in foresters' responses to questionnaire items. It deals with the independent variable arising from the 'interactions' of the forestry social organization with the forest, in terms of occupational activities (Table 4.2).

Professional foresters and others in the forest industries constitute a social organization, related to the forestry organizations through the various activities associated with the growth of trees, and their conversion into wood and wood based products. These activities are related to the various broad functions within forestry organizations. Members of these organizations interact in orderly ways by their cooperation and participation in roles (a task or job consisting of a set of related activities) within the role systems of these organizations.

FORESTRY ORGANIZATIONAL FUNCTIONS

A GENERAL FRAMEWORK

Within the fcrestry 'organization', foresters' activities can be grouped into broad functional roles. A typology of general organizational functions (Katz and Kahn, 1978) offers a suitable framework for a functional role structure within the Australian forestry profession (Table 9.1).

TABLE 9.1

Functional roles and activities within an organizational context

FUNCTIONAL ROLE		ROLE ACTIVITIES
I	Managerial	Control of and decision-making for the whole system; policy and overall planning; coordination
	Institutional supportive boundary with society	Obtaining social support and legitimacy for the activities of the institution; relating the activities of the institution to society
II	Administration	Ensuring the steady state of the organization; formalizing and institutionalizing procedures; socialization and training; rule enforcement.

III	Production	Activities directed towards task accomplishment, task requirements, job specifications and standards for the work process.
	Production supportive boundary with outside	Procuring and disposing of production including marketing of forest products
IV	Research	Research activities of various kinds, sensing change in the outside environment, and adapting the organization to these changes

Table 9.1 defines a functional role structure within an organizational context, comprising four major functions; managerial, administrative, production and research, and two interactive boundary support functions (institutional and production). The two boundary support functions act at the interface between the organization and society; eg in public relations and marketing of products.

FORESTRY FUNCTIONAL GROUPS

The functions described above provide a basis for analysing how the attitudes of foresters might be influenced by their forestry activities. Foresters' responses to the following question were used to define the activities to be assigned to the organizational functions.

What would best describe the type of forestry you are most involved in at present?

1. field operations and supervision
2. writing management plans
3. design of cutting plans
4. management planning
5. research
6. forest landscaping plans
7. forest engineering plans
8. policy development
9. training of forest gangs
10. administration of office personnel
11. forest inventory
12. other .....

Foresters added an additional 51 activities under 'other'. The listed and added activities were assigned to one of the four functional groups, taking into account the criteria described previously, and the particular forestry context in which these functions occur. These assignments are shown in Table 9.2, together with the percentage of respondents who indicated each activity within each group, and within the Institute sample. As a check, the assignments were given to an independent judge to assess the appropriateness of allocations.

The activities listed on the questionnaire and assigned to the managerial function relate generally to (1) senior management roles, e.g. 'policy development';

(2) a planning role, e.g. 'land use planning'; (3) a resource allocation role, e.g. 'forest economics'. Other activities assigned to this function include 'public relations', 'public information', 'recreation' and 'urban forestry', and are related to institutional supportive activities within society at large. Activities listed in this function would occur in a Division of Forest Management or Planning (for example see Appendix G).

Activities listed under 'production' relate generally to forestry activities at the operational level, including the harvesting of the forest. They also include the preparation of management plans, cutting and landscape plans, which relate to specifications for forest operations, the definition of operational tasks, supervision of their accomplishment and standards for operations. Such activities are related to 'production' functions as listed in Table 9.1. District management is included in this functional group rather than the 'managerial' group because the roles and activities of foresters at this level of management are concerned directly with forest harvesting operations. The activities listed here are those generally associated with a Division of Operations , or Marketing (Appendix G).

The activities of 'marketing forest products' and 'contract implementation' were also considered production supportive, as they relate to the procurement

TABLE 9.2

Assignment and distribution of activities in the functional groups, and the percent of foresters in each group and the Institute sample

I. The Managerial function

FORESTRY ACTIVITY	PERCENT OF FORESTERS FUNCTIONAL GROUP	PERCENT OF FORESTERS TOTAL SAMPLE
management planning	39.5	8.3
policy development	21.8	4.6
fire protection/planning	6.1	1.3
land use planning	3.4	0.7
consulting	5.4	1.1
recreation	5.4	1.1
forest economics	0.7	0.1
third world forestry	1.4	0.3
public relations/public information	3.4	0.7
Regional management	4.8	1.0
environmental impact statements	0.7	0.1
environmental planning	2.7	0.6
urban forestry	1.4	0.3
wildlife management	1.4	0.3
paper-mill management	1.4	0.3
water catchment management	0.7	0.1
TOTAL OF SAMPLE		20.9

TABLE 9.2 (continued)

II. The Production function

FORESTRY ACTIVITY	PERCENT OF FORESTERS FUNCTIONAL GROUP	TOTAL SAMPLE
field operations	69.5	30.5
writing management plans	3.9	1.7
design of cutting plans	2.6	1.1
forest landscape plans	1.9	0.9
forest engineering plans	1.0	0.4
forest inventory	6.5	2.8
private forestry	1.9	0.9
nursery practice	1.3	0.6
forestry extension	3.9	1.7
district management	1.9	0.9
logging trials	0.3	0.1
technical work	0.6	0.3
forest utilization	1.6	0.7
soil conservation	0.3	0.1
marketing forest products	2.2	1.0
contract implementation	0.3	0.1
TOTAL OF SAMPLE		43.9

TABLE 9.2 (continued)

III. The Administrative function

FORESTRY ACTIVITY	PERCENT OF FORESTERS FUNCTIONAL GROUP	TOTAL SAMPLE
administration of office personnel	27.3	1.3
training forest supervisors	15.2	0.7
management of reserves/N.Parks	27.3	1.3
training forest gangs	6.1	0.3
administration of research	6.1	0.3
administration of foresters	6.1	0.3
teaching foresters	6.1	0.3
management records	3.0	0.1
forest admin/supervision	3.0	0.1
TOTAL OF SAMPLE		4.7

IV. The Research function

FORESTRY ACTIVITY	PERCENT OF FORESTERS FUNCTIONAL GROUP	TOTAL SAMPLE
research	95.4	20.7
forest entomology	0.7	0.1
forest ecology	0.7	0.1
silviculture	3.3	0.7
TOTAL OF SAMPLE		21.7

TABLE 9.2 (continued)

V. Ungrouped activities

ACTIVITY	PERCENT OF TOTAL SAMPLE
unemployed	1.6
non-forestry student	0.1
forestry student	1.0
non-forestry	0.3
recent graduate	0.6
post-graduate student	0.1
retired	3.8
TOTAL	7.5

Note: As this group was excluded from analyses, only the total Institute percentages are shown.

of input, or the disposal of forest products, and were thus included here.

The activities assigned to the 'administrative' function were generally straightforward and related directly to the bureaucratic activities of an organization. These activities relate in some way to formal procedures, induction or socialisation, or rule enforcement as described in Table 9.1. Such activities occur in a Division of Administration (Appendix G).

Most of the foresters allocated to the 'research' function simply listed 'research' as the most relevant activity; i.e. they did not specify the nature of that research. Other activities allocated to this function include those listed as 'forest entomology', 'forest ecology' and 'silviculture'. It seemed these were more relevant to a research function than any other. Research activities occur within a Division of Technical Services (Appendix G).

The activities of members listed in the 'ungrouped' set were not considered part of active forestry in Australia. Students, unemployed, and retired foresters make up the bulk of this group (Table 9.2).

Allocation of Foresters to Functional Groups

Of those foresters who responded specifically to this question, 73.4 percent specified one of the 11 listed activities, while 26.6 percent specified an unlisted activity (other) illustrating the diversity of foresters' professional activities.

Most foresters (76.8 percent) nominated only one activity; 50.2 percent giving a listed item and 26.6 percent an 'other'. The remaining 23.2 percent gave a combination of activities with 6.9 percent using both listed and 'other' activities (Appendix H).

Where foresters gave more than one listed activity, they were assigned to the group corresponding to the first activity they nominated. Thus 23.2 percent may have been allocated to an inappropriate group, but as approximately 90 percent gave no more than two activities, the assignments can be taken to reflect the distribution of foresters in the different functions. In fact, where respondents listed two or more activities, most were within the same functional group.

Distribution of Foresters within Functional Groups

An analysis of the allocation of foresters to the functional groups (Table 9.2) provides a detailed description of foresters' activities, which is not available from any other source. Jennings and Bacon (1983) for instance, provide details of foresters' employment by five categories only. Data from this study are useful for further study of the Institute population, and provide some insight into the breadth of activities by members of a professional 'organization'.

Details of how forestry work activities are distributed within the Institute could provide information for the assessment of potential educational needs and manpower requirements, and studies on forestry organizations.

Most employed members of the Institute (92.5 percent) are involved in some way in 'forestry' related activities; i.e. with production and growth of trees, or the management and harvesting of forests.

Although there are many activities listed in Table 9.2; in the managerial group, management planning and policy development dominate (61.3 percent). In the production group, field operations activities, writing management plans, forest inventory and forestry extension account for 83.8 percent of the group. Administration of office personnel, training forest supervisors and managing reserves account for 69.8 percent in the administrative group. Research activities account for 95.4 percent of the research group.

The distribution of the functional groups by 'clearcutting' or 'non-clearcutting' States (Table 9.3) illustrates the allocation of forestry activities to the functional groups among the States, and some functional similarities and differences between 'clearcutting' and 'non-clearcutting' States.

As Table 9.3 indicates, there is no real difference in the proportions of each functional group among either the 'clearcutting' or the 'non-clearcutting' States (Chi square = 21.27; n.s., and Chi square = 16.24; n.s., respectively).

As Figure 9.1 illustrates, within the 'clearcutting' group, the distribution of foresters by function is approximately similar on a State by State basis. The percentage of foresters allocated to the 'production' function varies from 45.3 to 54.7; in 'research' from 14.9 percent in N.S.W. to 20.5 percent in Tasmania. Administrative foresters make up 1.2 percent in Tasmania, 5.8 percent in Victoria. Managerial foresters make up 16.2 percent of N.S.W. foresters and 30.1 percent in Tasmania.

Of the 'non-clearcutting' States (Figure 9.2) the distribution of functional groups in South Australia is similar to that of the four states in the 'clearcutting' group. As forestry in S.A. is essentially production oriented, the similarity to the 'clearcutting' States in the distribution of foresters within the groups may be a reflection of the allocation of organizational resources in the more production oriented forestry systems.

Given the location of the C.S.I.R.O. Division of Forest Research, and the A.N.U. Department of Forestry in the A.C.T., the high proportion of research foresters in the territory is understandable. Queensland also has a high proportion of research foresters. This may be related to the diversity of forestry practised in

TABLE 9.3

The distribution of foresters in the functional groups by 'clearcutting' and 'non-clearcutting' States

STATE GROUP	FUNCTIONAL GROUP Managerial	Administrative	Production	Research
		PERCENT		
'non-clearcutting'				
A.C.T.	15.9	7.9	25.4	42.9
QLD	15.8	9.2	32.9	31.6
S.A.	27.6	1.7	43.1	20.7
'clearcutting'				
N.S.W.	16.2	4.1	54.7	14.9
VIC	21.6	5.8	45.3	16.3
W.A.	23.3	2.7	47.9	17.8
TAS	30.1	1.2	45.8	20.5
Total members	20.9	4.7	43.9	21.7

Between 'clearcutting' and 'non-clearcutting' $\text{Chi}^2 = 28.47$; $p < .01$

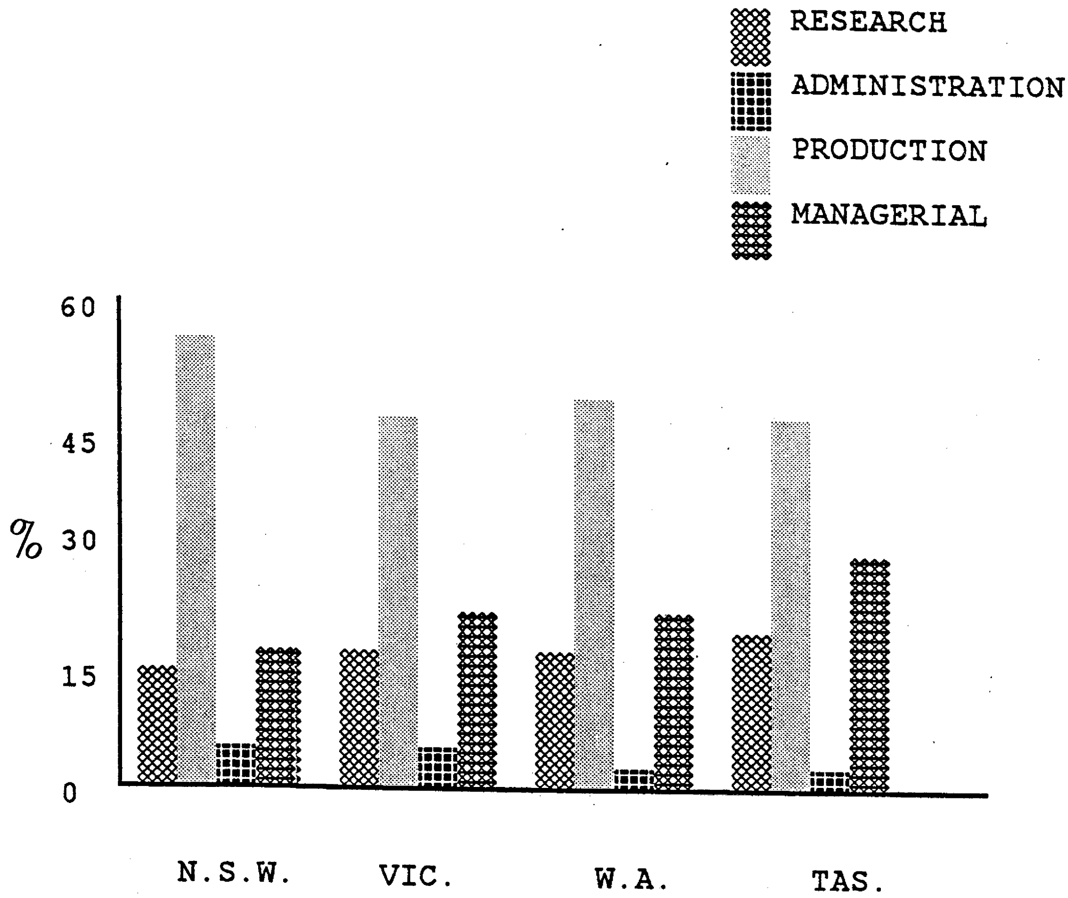

FIGURE 9.1

DISTRIBUTION OF OCCUPATIONAL GROUPS

CLEARCUTTING STATES

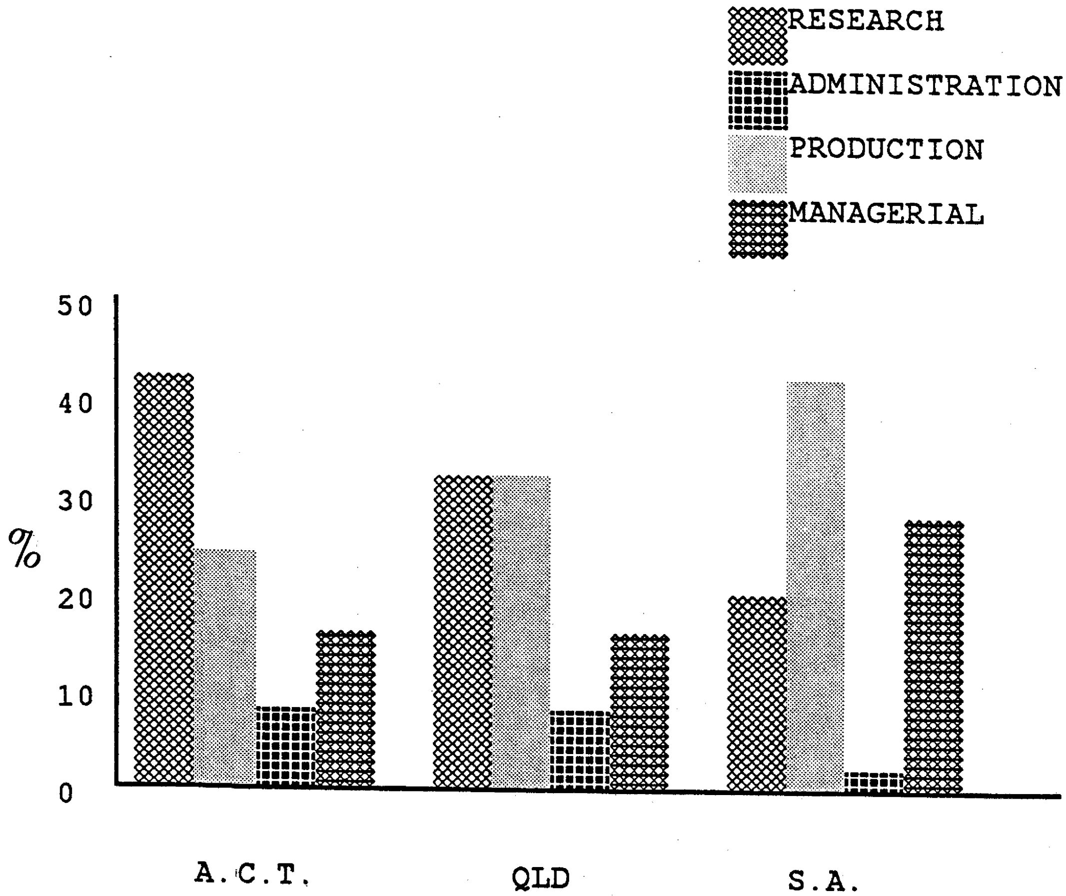

FIGURE 9.2

DISTRIBUTION OF OCCUPATIONAL GROUPS

NON-CLEARCUTTING STATES

Queensland (rain forests, hardwood forests, cypress pine, Araucaria and exotic pine forests), and the historical emphasis given to research in that State.

For all States, the smallest functional group is administration. The relative proportion of administrative, production, and managerial foresters is similar, however, within all States.

The preponderance of 'production' foresters in 'clearcutting' States could be explained on the basis of timber production from these States. As described in Chapter 2, the States with the highest output of timber and timber products are those grouped within the 'clearcutting' category.

Within the 'clearcutting' States and within the 'non-clearcutting' States, the proportions of each functional group are similar except for differences noted previously. However, there are significant differences between the 'clearcutting' and 'non-clearcutting' States in the proportions of each functional group. Such differences may reflect differences of emphasis; the production function in 'clearcutting' States and the research function in 'non-clearcutting' States.

ATTITUDE VARIATION AMONG FUNCTIONAL GROUPS

Different occupational roles are related to different 'role settings'. Thus, production activities take place within the actual forest environment, while policy decision-making activities are generally confined to organizational or bureaucratic settings. Such role settings generate different social environments.

Previous analyses (Chapters 6, 7 and 8) have shown how social experience and participation in a social environment influences the attitudes of foresters.

There could also be differences in attitudes between foresters in the different functional groups, particularly if their activities are associated with different types of social experience, or occur within different types of social environments.

Interactions between the forestry social organization and the forest (Table 4.2) in terms of hierarchy are relevant here. A hierarchy reflects a social structure in which different parts of the structure might be expected to show differences in their 'commands over actions or resources, or the allocation of these resources" (Nadel, 1957). The functional groups represent major divisions of an organizational structure, such as represented in organizational charts (Appendix G). Description of these divisions does not, however, suggest how each functional group is related to one another in terms of vertical distributions of resources, such as prestige, status or power, throughout the organizational hierarchy.

In examining differences in attitudes between members of the functional groups, several questions are important. Does the nature of role activities produce a particular type of social environment resulting in differences in the attitudes of foresters? Does engaging in a particular forestry activity have a generalised effect on attitudes? Thus, does working in production activities in any of the States generate similar attitudes among those foresters? Each of these questions can be addressed in this study.

To determine whether occupational role affects foresters' attitudes, we can use an analytical approach similar to that used previously. A oneway MANOVA using the four functional groups as categories of occupation, and the cognitive, affective and conative attitude scales as dependent variables is shown in Table 9.4 indicating that membership of the different functional groups corresponds to differences in attitude scores. Foresters' attitude scores are significantly different on the basis of membership of one of the four designated functional groups on 9 of the 13 attitude scales (Table 9.4).

As there are four categories of functional role, there are potentially four different ways by which attitude scores may vary, one for each group category. A MANOVA dimension reduction analysis indicates however, that there are in fact, two statistical dimensions within the four functional groups accounting for variation in attitude scores. The MANOVA does not indicate the nature of these dimensions so it is necessary to explore this further.

TABLE 9.4

The effect of occupational role: MANOVA

Multivariate F = 2.50; $p < .01$

ATTITUDE SCALE	Univariate tests F	p	df
Cognitive			
AMBIA	23.77	xxx	3624
HYDROL	14.72	xxx	
ECOL	0.59	ns	
NUTRIN	16.09	xxx	
Affective			
ECOEFF	23.61	xxx	
HYDEFF	19.44	xxx	
LANDSC	15.25	xxx	
Conative			
LNDSTR	6.65	xx	
PSTSTR	0.75	ns	
WLDSTR	0.90	ns	
REGSTR	-	ns	
HYDSTR	33.26	xxx	
SILSTR	22.81	xxx	

N = 640 xx $p < .05$ xxx $p < .01$

Dimension reduction analysis indicates 2 significant dimensions exist in the data

FACTORS UNDERLYING GROUP DIFFERENCES

A starting point for identifying the nature of the two dimensions underlying variation in foresters' attitude scores is to compare the scale means for all groups. The scale means and standard deviations in z score form are thus shown in Table 9.5.

This table suggests that there are two empirical dimensions underlying occupational effects on attitude. As can be seen, the groups 'research' and 'administration' have positive scale means, while the groups 'production' and 'managerial' have negative scale means. Positive scale means correspond to responses on the items indicating less favourable attitudes towards clearcutting, while negative scale means correspond to responses indicating more favourable attitudes, generally.

These data are presented in Figure 9.3 to clarify differences in scores between the four groups. The two dimensions underlying attitude differences are readily seen in this figure. These dimensions seem to correspond to activities associated with forest management directly, 'managerial' and 'production', and to activities not associated with forest management directly, 'administration' and 'research'.

Table 9.6 summarises differences between the individual groups on individual attitude scales. This table shows there are few differences between the two groups 'managerial' and 'production', differing only on LNDSTR and HYDSTR, and only one difference between the

TABLE 9.5

Attitude score variation among functional groups

SCALE	RESEARCH			ADMINISTRATION			MANAGERIAL			PRODUCTION		
	SCALE MEAN	SD	ITEM MEAN	SCALE MEAN	SD	ITEM MEAN	SCALE MEAN	SD	ITEM MEAN	SCALE MEAN	SD	ITEM MEAN
Cognitive												
AMBIA	0.20	.79	0.54	0.54	.86	0.57	-0.07	.90	0.52	-0.14	.76	0.52
HYDROL	0.19	.04	0.52	0.33	1.11	0.53	-0.10	.93	-0.50	-0.13	.92	0.49
ECOL	0.07	.74	0.35	0.17	.96	0.36	-0.03	.76	0.35	-0.06	.73	0.34
NUTRIN	0.20	.78	0.34	0.12	.82	0.34	-0.15	.73	0.32	-0.09	.74	0.32
Affective												
ECOEFF	0.37	1.10	2.64	0.30	1.20	2.60	-0.24	1.02	2.54	-0.12	1.03	2.56
HYDEFF	0.26	.93	2.51	0.20	.94	2.49	-0.15	.90	2.38	-0.13	.96	2.39
LANDSC	0.22	.89	2.37	0.13	.81	2.35	-0.09	.87	2.31	-0.09	.77	2 31
Conative												
LNDSTR	0.10	.85	3.26	0.10	.90	3.26	0.07	.81	3.24	-0.10	.84	3.10
PSTSTR	0.05	.80	2.89	0.03	.76	2.89	0.02	.79	2.88	-0.04	.85	2.89
WLDSTR	0.07	.78	3.70	0.10	.77	3.70	0.003	.72	3.69	0.06	.75	3.70
REGSTR	0.003	.70	3.92	0.14	.70	3.98	0.03	.67	3.93	0.04	.66	3.93
SILSTR	0.16	.61	2.97	0.17	.73	2.97	-0.05	.62	2.93	-0.12	.62	2.91
HYDSTR	0.23	.79	3.36	0.25	.82	3.37	0.04	.77	3.29	-0.20	.82	3.19

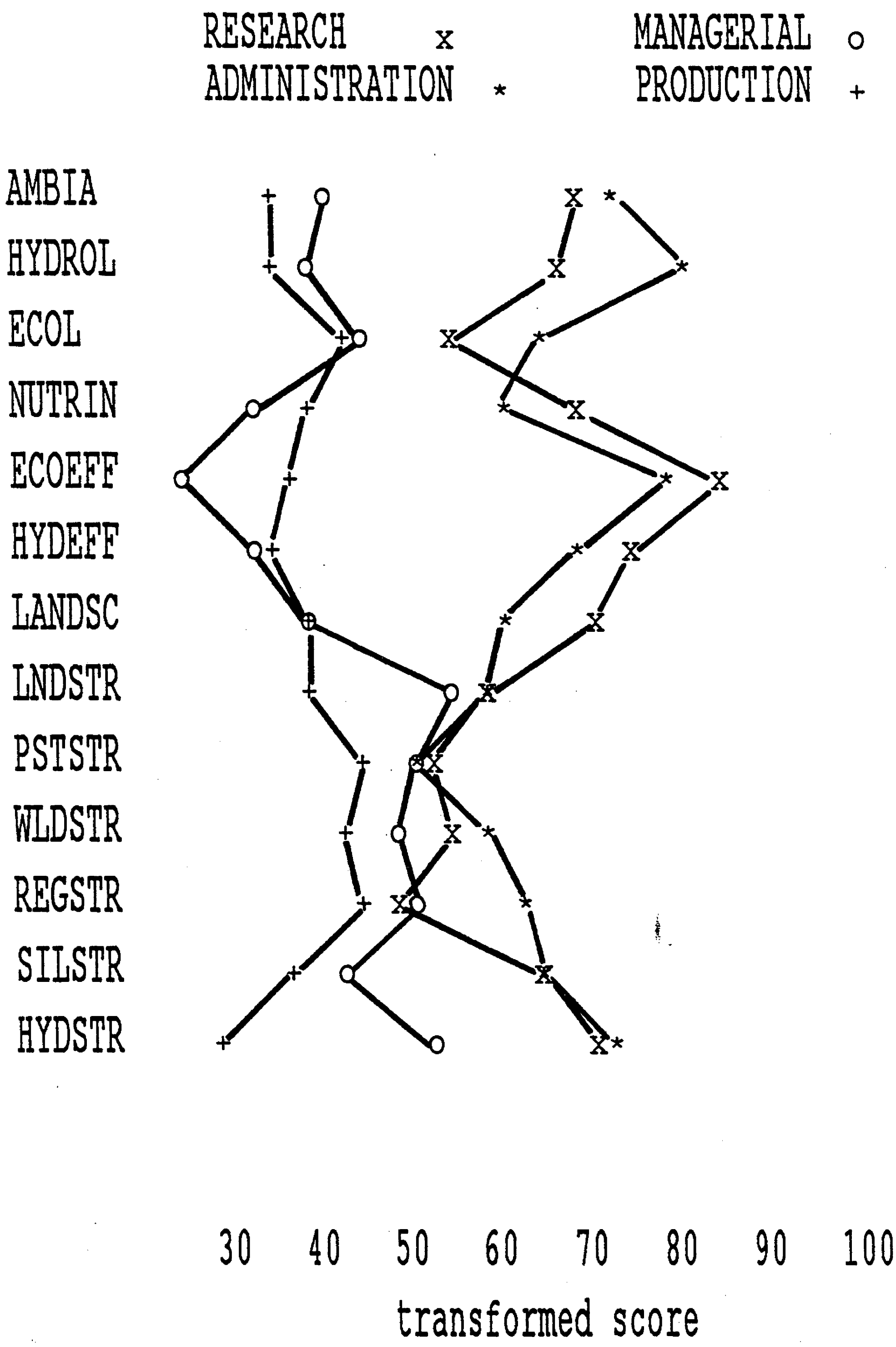

FIGURE 9.3

ATTITUDE VARIATION WITH OCCUPATIONAL ROLE

TABLE 9.6

Differences between the functional groups on attitude dimensions

GROUP	GROUP			
	managerial	administrative	production	research
managerial	X	AMBIA*** HYDROL** NUTRIN* ECOEFF*** HYDEFF* SILSTR*	LNDSTR** HYDSTR**	AMBIA** HYDROL** NUTRIN*** ECOEFF*** HYDEFF*** LANDSC*** SILSTR*** HYDSTR**
administrative		X	AMBIA*** HYDROL*** ECOL* ECOEFF** HYDEFF* SILSTR** HYDSTR***	AMBIA**
production			X	AMBIA*** HYDROL*** NUTRIN*** ECOEFF*** HYDEFF*** LANDSC*** LNDSTR** WLDSTR* SILSTR*** HYDSTR***
research				X

two groups, 'administration' and research', AMBIA. However, both the 'managerial' and 'production' groups differ on half or more scales from both 'research' and 'administration' foresters.

Having identified the existence of two distinct attitudinal 'camps' within the Institute membership, we need to look further to seek out factors associating the groups together.

There are several candidates for examination in this respect, including social environment and experience. The social environment effects of territory and membership of conservation organizations could be important in creating similarities among the two occupational attitude dimensions.

Territory Effects

Table 9.3 indicates differences in the proportions of the functional groups between the 'clearcutting' and 'non-clearcutting' States; the 'clearcutting' States having more managerial and production foresters than the 'non-clearcutting' States. Thus, we might expect the effect of residence in a 'clearcutting' State (Chapter 6) to be more apparent among 'managerial' and 'production' foresters than 'research' and 'administration'.

However, it is necessary to test for interaction between territory location and occupational role, to be assured that territory location could be a factor leading to reduced agreement on items among 'managerial' and 'production' foresters. If there is no interaction then the two factors are independent, and territory location would be operating as a factor affecting attitudes among the occupational groups.

The multivariate test for interaction between territory and occupational group, F = 1.02, is not significant. There was no univariate test significant for the interaction effect. Thus, territory could be partly responsible for similarity between 'managerial' and 'production' foresters, and also between 'research' and 'administration' foresters, as most of these foresters are in the 'non-clearcutting' States.

Conservation Organization Members

Membership of conservation organizations was important in determining foresters' attitudes (Table 7.1). Thus, the distribution of such members among the four occupational groups could also have a bearing on the observed attitude differences. The distribution of such membership is shown in Table 9.7.

Table 9.7 shows that variation exists in the number of members of conservation organizations in each functional group. The 'administration' and 'research' groups have the highest proportions, while there are a smaller number among 'managerial' and 'production' foresters. As membership of conservation organizations was found previously to be associated with more agreement with questionnaire items, such members among the 'research' and 'administration' groups could be partly responsible for the higher level of agreement with the items among these foresters.

TABLE 9.7

The distribution of members and non-members of conservation organizations among the functional groups

FUNCTIONAL GROUP	PERCENT OF FORESTERS 'MEMBERS'	'NON-MEMBERS'
Managerial	22.4	77.6
Production	14.6	85.4
Administration	24.2	75.8
Research	27.6	72.4

$Chi^2 = 11.92$; $p < .01$

As before, we need to test for interaction between membership of conservation organizations and occupational role. The multivariate F for this test is 0.99, which is not significant. There were no univariate F values significant. Thus, such membership is certainly a possible source of attitude variation between the four groups. This source of variation is examined in more detail in Chapter 10.

Experience Effects

A third source of similarity within the 'managerial' and 'production' groups, and the 'research' and 'administration' groups is the extent of experience with clearcutting operations. As shown previously (Chapter 8), there is some interaction between field and management experience of clearcutting. Table 8.8 illustrates that management experience is more important as a factor affecting attitude scores than field experience, as there are significant univariate tests for management experience with and without field experience included in the MANOVA model. When management experience is included in the model for field experience, the effect of field experience is considerably reduced (Table 8.8).

For these reasons, the effect of management experience among the four groups will be more useful than the effect of field experience. As an indication of this possibility, the distribution of management experience among the four groups is shown in Table 9.8.

Management experience of clearcutting is not distributed evenly among the four functional groups. As Table 9.8 shows, the 'managerial' and 'production' groups have more experienced foresters in managing clearcutting operations than have the 'research' and 'administration' groups.

However, there are three times as many experienced foresters among the 'administration' group than the 'research' group. Nevertheless, it seems likely that management experience could be partly responsible for segregating the attitudes of the two functional group sets.

As there is a significant difference in the proportions of foresters with management experience among the groups ($Chi^2 = 77.37$; $p < .01$), and management experience has a significant effect on attitudes (Table 8.7) generating more favourable attitudes towards clearcutting with increasing experience, this effect is also partly responsible for differences between the 'production' and 'managerial' foresters and the 'research' and 'administration' group.

TABLE 9.8

Management experience among the functional groups

		Management experience Percent		
GROUP	NONE	1 to 5 years	6 to 10 years	more than 10
Managerial	29.2	34.6	19.2	16.9
Administrative	36.4	33.3	18.2	12.1
Production	35.8	30.9	13.2	19.8
Research	73.0	20.4	2.0	4.6

$Chi^2 = 77.37$; $p < .01$

An analysis of the influence of management experience can be obtained by ordering the functional groups on the basis of their management experience and applying a Chi square analysis. This is shown in Table 9.9 where significant differences occur between the scores of the different groups on the basis of their members with more than 10 years management experience.

Those groups with most management experience among members have the most favourable attitudes. These are the 'production' and 'managerial' groups. (See also Table 9.5).

TABLE 9.9

Analysis of rank of functional groups by management experience, and attitudes towards clearcutting

SCALE	Chi^2	p	Direction of Correlation
Cognitive			
AMBIA	25.05	***	-ve
HYDROL	14.07	***	-ve
ECOL	3.12	ns	-ve
NUTRIN	19.40	***	-ve
Affective			
LANDSC	7.28	ns	-ve
HYDEFF	15.70	***	-ve
ECOEFF	21.20	***	-ve
Conative			
WLDSTR	10.01	ns	-ve
LNDSTR	3.20	ns	-ve
SILSTR	17.06	***	-ve
REGSTR	3.20	ns	-ve
HYDSTR	15.89	***	-ve
PSTSTR	1.35	ns	+ve

Notes: *$p < .10$; **$p < .05$; ***$p < .01$
ns not significant

Table 9.9 shows a negative relationship between the functional groups ranked on management experience (more than 10 years) and attitude, which illustrates a tendency for increasingly favourable attitudes from the 'administrative' and 'research' foresters to the 'managerial' and 'production'.

SUMMARY

Attitude variation is examined in terms of social environment and experience. Each of these factors affected attitudes and accounted for some of the variation.

Not all variance can be accounted for by the variables used in this study, however, as the idiosyncratic effects of personality, culture and other factors cannot be included in a study of this nature.

Thus far we have not examined how variation in the involvement of each functional group in organizational activities, such as decision-making, might affect attitudes of foresters in the differing functional areas.

As noted previously, the two groups of 'production' and 'managerial' foresters carry out activities associated with forest management directly, while the activities of 'administration' and 'research' are not directly related to forest management.

This chapter illustrates that occupational role has an effect on foresters' attitudes, and suggests that 'clearcutting' State residence, membership of conservation organizations and management experience varies between the functional groups. Membership of 'production' and 'managerial' groups is associated with disagreement with items (favourable attitudes towards clearcutting) while membership of 'administrative' and 'research' groups is associated with agreement with items (unfavourable attitudes towards clearcutting).

Table 9.5 and Figure 9.3 indicate a tendency for increasing agreement with items from the 'production' and 'managerial' groups to the 'administration' and 'research' groups. Social dimensions underlying the differences between the groups could be associated with differences in the involvement of these groups in forest management decision-making.

In the next chapter, such sources of organizational involvement by the four groups are examined, in order to determine whether such involvement can account for variation in attitude scores.

CHAPTER 10

ATTITUDE VARIATION AND SOCIAL HIERARCHIES

A BASIS FOR GRADIENTS IN ATTITUDES

The attitudes of foresters differed between four organizationally defined groups (Chapter 9). The 'managerial' and 'production' foresters differed on six or more scales from the 'research' and 'administrative' foresters. However, 'managerial' foresters differed on only two scales from 'production' foresters, and 'research' foresters differed on only one scale from 'administrative' foresters (Table 9.6).

The data showed a gradation in attitudes generally from the 'production' and 'managerial' foresters with negative scale means indicating favourable attitudes (disagreement with questionnaire items) to the 'administrative' and 'research' foresters with positive scale means indicating less favourable attitudes (agreement with items).

On the basis of this, it seemed possible the more favourable attitudes of 'managerial' and 'production' foresters towards clearcutting might reflect their greater management experience, association with a 'clearcutting' State and lesser association with conservation organizations.

It is shown by regression analysis (Table 8.9) that there is an independent and additive effect by these factors. It is possible that variation between the groups in terms of their organizational decision-making, as is suggested by the theoretical framework (Table 4.2) and by the results of Chapter 9, could generate differences in attitudes.

Chapter 3 and table 4.2 suggest that variation exists in the nature of social interactions experienced by different social groups, generating social environmental gradients. This chapter thus addresses two issues. The first is whether the gradation in attitudes between the four groups is associated with variation in the potential access of each functional group to decision-making processes. The second is whether variation in involvement in conservation organizations is associated with the gradational attitude response.

In order to establish whether differences in attitudes between the functional groups might be associated with the position of those groups within a social hierarchy, or along a social environmental gradient, the position of each group in such a 'social hierarchy' must be defined.

As indicated in table 4.2, a social hierarchy would exist in terms of potential access to policy decision-making. Such a hierarchy reflects differences in the social interactions foresters in the different functional groups would have in decision-making processes about the use of clearcutting versus some other silvicultural practice.

The inferred position of each functional group within such a social hierarchy can be used to test whether there is a gradational change in attitude towards clearcutting with access to decision-making.

A SOCIAL HIERARCHY OF ACCESS TO DECISION-MAKING

An examination of the relationship between attitude and access to decision-making requires that the order of each group be established in terms of such access or responsibility.

The actual processes or people involved in such decisions in a particular organization is not of concern here, except to note that there may be informal practices underlying these decisions. Janis (1982) provides examples of social situations within organizations that have led to decision-making not associated with any formal procedures.

While there is both theoretical and empirical guidance by which to order the groups, assumptions must be made about the exclusivity of access to such decisions. Other parties, such as outside interest groups (Culhane, 1981) may have considerable influence on specific policies or strategies.

However, we must assume the 'policies' or strategies originate within the forestry organizations and that outside influence is restricted.

Given these limitations and assumptions, the following order was determined by considering the nature of organizational behaviour and bureaucratic structures (Katz and Khan, 1978; March and Simon, 1958; Moore, 1951; Stagner, 1969; Roethlisberger, 1941; Pfeffer and Salancik, 1974), and the nature of policy influence within the U.S. Forest Service (Kaufman, 1960).

Most foresters work in bureaucracies or organizations having an organized division of functions. Each of the four functional groups has differing formal access to the 'policy' or strategy decisions made in Australian forestry.

RANKING FUNCTIONAL GROUPS

The activities of the 'managerial' group involve direct influence in these decisions. This group has a filtering function in policy determination (Katz and Kahn, 1978). There are also many experienced foresters in this group, with 36 percent having 6 years or more management experience, providing a significant pool of knowledge about policy development and procedure.

Foresters within the 'managerial' group having institutional supportive roles, such as 'public relations' would also make a major contribution to policy formulation (Presthus, 1978) through their contacts with outside organizations and users of forest products; they operate at the interface between foresters and industry, where the requirements of both industry and the public must be considered. The managerial group is expected to have most access generally to policy decision-making in Australian forestry organizations as Table 9.1 suggests.

The 'production' group foresters have operational responsibility implementing decisions in the field. These foresters, although below senior managers in direct line responsibility, would nonetheless contribute to decision-making, particularly those in the production-supportive roles (Katz and Kahn, 1978), and those in the front line of activity.

Kaufman (1960) showed that policy changes were bound to fail if they were not accepted by field foresters. Foresters at this level may thus have more influence on 'policy' matters than their relative seniority within forestry organizations might suggest. However, these foresters are not directly responsible for policy decision-making and would be ranked below those in managerial roles, because they have less of a planning role, and more of a task accomplishement role (Table 9.2). Production foresters would be ranked above 'research' and 'administrative' foresters because of greater access to the decisions made about forest management. Research foresters have irregular access to policy decision-making, 'administrative' officers as defined by Table 9.2 are concerned mainly with the details of 'running' the organization.

The 'research' group may contribute to policy development to a limited extent; for example through involvement in government committees of enquiry, consultancies, research journals, conferences or secondment to government agencies. These may not be formalised procedures, but enable such foresters to present different points of view and alternative strategies.

Research foresters do not normally have direct line responsibilities for organizational decision-making within production oriented organizations. Input into such decisions is generally advisory arising from specific research findings. Thus, 'research' foresters have limited access, and whose main role is to provide the information for policy-makers to act on. Research foresters would have more access to policy level decisions than the 'administrative' foresters, because of involvement in policy related research activities among the 'research' group.

The 'administrative' foresters may not have much direct input into policy decision in a formal way. This group is concerned with maintaining the organization in a 'steady state'; policy development may cause administrative foresters some concern if it requires changes to procedures. The nature of an organization's activities may, in fact, be of secondary importance to administrative staff, where rules or procedures become ends in themselves (Merton, 1952; March and Simon, 1958). The 'administrative' foresters provide services to the organization, but have no direct line responsibility for policy decisions. However, this group could have effects on strategy decisions or the implementation of these strategies, if changes are introduced in accounting procedures, recording systems, or other office procedures, for instance. As a rule, administrative tasks are not directed to organizational policy initiatives, although some administrative officers may have informal influence on policies. Thus, 'administrative' foresters are concerned with recording the organization's activities and progress, and less with decisions about what those activities will be. The 'administrative' group has no claims to place it above any of the others.

The rank order of the four groups on the basis of the above considerations is shown in table 10.1.

TABLE 10.1

Formal access to decision-making

Functional group	rank
administration	4
research	3
production	2
managerial	1

ATTITUDE VARIATION WITH ACCESS TO DECISION-MAKING

In order to test whether attitude scores were related to the position of the functional groups in the hierarchy described above, a Chi-square analysis was applied to the ranking of groups and attitude scores.

Before proceeding with the analysis, the attitude scores were recoded. As the factor scale scores provide many more score values than there are foresters to take them, a cross tabulation of 'formal access' rank by attitude score would produce many empty cells, thus limiting the usefulness and meaning of a Chi-square analysis severely. It was thus necessary to limit the attitude score values to those of the actual population of foresters, and was achieved in the following manner.

The scores were recoded into two categories, low and high. The scale mean was used to recode scores into those below and including the mean, and those above the mean. On this basis there would be approximately equal numbers in each 'new' score category.

Each scale was analysed separately, and each had a different range of scores that were low or high. Low scores are the equivalent of negative scores in previous analyses, reflecting more favourable attitudes towards clear-cutting than high scores, which are the equivalent of positive scores, reflecting greater agreement that environmental effects are probable (less favourable attitudes towards clearcutting).

A significant relationship between rank order and attitude scores has occurred on 8 of the 13 scales, with 11 out of 13 having negative relationships (Table 10.2). On the cognitive scales, three (AMBIA, HYDROL, NUTRIN) have significant Chi square values, while all four have negative relationships showing a trend for more favourable attitudes towards clearcutting with increasing access to decision-making. On the affective scales, all three (LANDSC, ECOEFF, HYDEFF) have significant Chi square values, and negative relationships. Of the conative scales (SILSTR, HYDSTR and WLDSTR) have significant values, while four have negative, and two, positive relationships.

All scales except two (WLDSTR and PSTSTR) show a negative trend between position in the hierarchy and attitude score, indicating increasingly favourable attitudes towards clearcutting with increasing access to decision-making. The scales on which this trend is most evident are AMBIA, NUTRIN, ECOEFF and SILSTR. A change in attitude occurs between the groups with moderate to most access to decision-making ('production' and 'managerial') and those with little or limited access ('research' and 'administration') as illustrated by Table 9.5 and Figure 9.3.

The Chi square analysis suggests that a gradient in attitude towards clearcutting occurs along a gradient in access to decision-making. A gradient in access to decision-making represents a vertical gradient in the organization in terms of 'command over resources'. (Nadel, 1957). This analysis suggests that different positions in such a vertical gradient engender varying attitudinal responses.

It is also possible that foresters with decision-making or policy formulation roles have different attitudes because of the effect of 'institutional factors'. Policy makers often have to contend with 'political reality', and make bargains rather than develop innovative ideas (Lindblom and Cohen, 1979). In resource based organizations, such as forest services, policy makers may also have short time horizons, because of political or other factors, which tend to produce 'economically sound' rather than 'environmentally sound' natural resource policies (Wolfe, 1981; Stan. Res. Ins., 1982). Although in forestry,

TABLE 10.2

Analysis of rank of functional groups by 'formal access to decision-making' and attitudes towards clearcutting

ATTITUDE SCALE	Chi^2	p	Direction of relationship
Cognitive			
AMBIA	24.23	***	-ve
HYDROL	14.07	**	-ve
ECOL	3.12	ns	-ve
NUTRIN	19.40	***	-ve
Affective			
LANDSC	6.56	*	-ve
HYDEFF	15.69	*	-ve
ECOEFF	21.19	***	-ve
Conative			
WLDSTR	5.51	ns	+ve
LNDSTR	3.20	ns	-ve
SILSTR	17.06	***	-ve
REGSTR	3.20	ns	-ve
HYDSTR	15.89	**	-ve
PSTSTR	1.35	ns	+ve

Notes: *$p < .10$; **$p < .05$; ***$p < .01$
ns not significant

long growth periods are required and managed for, other institutional factors, such as reward systems, social networks, career patterns, or time pressures could also affect attitudes. It may not be possible for policy makers to express an 'ecological consciousness' (Leff, 1978) or an 'environmental sensitivity' (Mead, 1967) because of their need to make organizationally oriented decisions and their use of economic theories unrelated to ecology (Stan. Res. Ins., 1982).

This analysis also shows that those foresters who have responsibility for management are polarized from those foresters who do not. Thus, attitudes within an organization may be split down the middle on certain policy issues.

A SOCIAL HIERARCHY OF 'ENVIRONMENTALISM'

Table 9.7 shows that membership of conservation organizations varies between the four functional groups. Such membership has an effect on attitude scores among the Institute of Foresters as a whole (Table 7.1). If the ecological processes proposed by the theoretical framework (Table 4.2) are operating among foresters in their functional roles, we would expect to find a relationship between the extent of membership of such organizations among the functional group and attitudes, through the effect of interactions with 'other social arenas'.

Thus, membership of conservation organizations provides another social hierarchy ('environmentalism'), which is empirically defined, and could be used to examine gradation in attitudes. The rank order and position of each group in such a hierarchy is thus shown in Table 10.3 (based on Table 9.7).

TABLE 10.3

'Environmentalism' among the Functional Groups

Functional group	Rank
Research	1
Administrative	2
Managerial	3
Production	4

Comparing this ranking with that based on access to decision-making (Table 10.1) shows that a social hierarchy based on membership of conservation organizations is approximately the reverse of the former. However, if the groups are ranked on management experience (Table 9.8) using more than 10 years management experience as a criterion, the ranking based on membership (Table 10.3) is the exact reverse.

This suggests that foresters who are likely to be involved in policy making or policy related areas are not as involved in conservation organizations. The two groups with least policy involvement ('administration' and 'research') have the most members in such organizations. Senior members of organizations and field based staff may have less time to devote to such organizations, or may find the cross loyalty pressures undesirable.

Administrative and research foresters have less need to be committed to organizational activities as the 'production' or 'managerial' groups, and would feel less cross pressure from divided loyalties.

ATTITUDE VARIATION WITH 'ENVIRONMENTALISM'

The relationship between attitude and 'environmentalism' is positive (table 10.4). Thus, with increasing numbers of members of conservation organizations within a functional group there are increasing attitude scores and less favourable attitudes towards clearcutting. This is in contrast to the negative relationship between attitude and access to decision-making (Table 10.2).

TABLE 10.4

The relationship between attitudes
and 'environmentalism'

ATTITUDE SCALE	Chi^2	p	Direction of Correlation
Cognitive			
AMBIA	25.05	***	+ve
HYDROL	14.07	***	+ve
ECOL	3.12	ns	+ve
NUTRIN	19.40	***	+ve
Affective			
LANDSC	7.28	ns	+ve
HYDEFF	15.70	***	+ve
ECOEFF	21.20	***	+ve
Conative			
WLDSTR	10.01	ns	+ve
LNDSTR	3.20	ns	-ve
SILSTR	17.06	***	+ve
REGSTR	3.20	ns	+ve
HYDSTR	15.89	***	+ve
PSTSTR	1.35	ns	-ve

Notes: *$p < .10$; **$p < .05$; ***$p < .01$
ns not significant

ATTITUDE CONSISTENCY WITHIN SOCIAL HIERARCHIES

The previous analyses confirmed the existence of gradational attitudes within social hierarchies in the profession. However, it needs to be shown that the results are not merely artefacts of the ordering variables used and that there is consistency in attitudes at each position within a hierarchy, for example, across territorial boundaries, such as State of residence, or forestry employment.

Thus, if attitudes vary along social environmental gradients, those persons occupying the same relative position along a specified gradient should exhibit similar attitudes, as social conditions at each position should be similar.

Support for the existence of attitude gradients corresponding to social environmental gradients could be obtained by examining the attitudes of each functional group for each State. This could be addressed by examining the hypothesis that foresters in a particular functional group hold similar attitudes, regardless of their physical location.

The mean scores for the cognitive, affective and conative scales are thus compared using Student's t statistic. New South Wales was selected as the basis for comparison with all the other States, as this State has the largest group of foresters. Each functional group within this State was compared with the same group in each of the other States. The results of the analyses follow for each functional group.

RESEARCH FUNCTION

A comparison of the mean scores of the cognitive, affective and conative scales for 'research' foresters in N.S.W. with those in the other States shows only limited differences between these foresters in any of the States (Table 10.5).

Research foresters in the A.C.T., Tasmania and Victoria were similar to those in N.S.W. on all except one scale, while foresters in W.A. were similar on all except two. Research foresters in Queensland were similar on all but five, and South Australia on all but four scales with N.S.W. foresters.

The greater number of non-significant differences suggests that few real differences exist between the 'research' foresters across Australia. This suggests that the roles and activities of 'research' generate a social 'micro' environment, which leads to similar attitudes among such foresters. A similarity also exists in the limited access to decision-making among 'research' foresters, and the tendency for 'research' foresters to belong to conservation organizations. Thus, the hypothesis that attitudes are similar within the 'research' groups across Australia can be supported by the data of Table 10.5, as there are insufficient significant differences to warrant rejecting the null hypothesis.

TABLE 10.5

Comparison of 'research' foresters in N.S.W.
with 'research' foresters in other States

SCALE	A.C.T. (x-NSW) t	p	VIC. (NSW-x) t	p	QLD (NSW-x) t	p	S.A. (NSW-x) t	p	W.A. (NSW-x) t	p	TAS (NSW-x) t	p
AMBIA	-0.26	ns	1.92	ns	0.10	ns	0.73	ns	2.31	**	2.60	**
HYDROL	0.76	ns	1.03	ns	1.99	*	-1.13	ns	-0.96	ns	-0.36	ns
ECOL	1.74	*	0.34	ns	-0.93	ns	1.08	ns	0.61	ns	0.11	ns
NUTRIN	1.07	ns	0.80	ns	-1.55	ns	2.18	**	-0.73	ns	0.17	ns
ECOEFF	1.26	ns	0.87	ns	-1.45	ns	1.25	ns	-0.09	ns	0.35	ns
HYDEFF	0.72	ns	0.11	ns	-1.62	ns	-1.67	ns	0.52	ns	1.07	ns
LANDSC	-0.75	ns	2.30	**	-0.56	ns	1.43	ns	0.41	ns	-0.93	ns
LNDSTR	0.04	ns	1.59	ns	-0.75	ns	1.91	*	1.34	ns	0.91	ns
PSTSTR	1.26	ns	-0.84	ns	-2.35	**	-2.62	**	-2.63	**	0.30	ns
WLDSTR	0.66	ns	-0.80	ns	-1.34	ns	0.04	ns	-0.80	ns	0.04	ns

TABLE 10.5 (contd)

SCALE	A.C.T. (x-NSW) t	p	VIC. (NSW-x) t	p	QLD (NSW-x) t	p	S.A. (NSW-x) t	p	W.A. (NSW-x) t	p	TAS (NSW-x) t	p
REGSTR	0.72	ns	0.14	ns	1.76	*	-1.08		-0.51	ns	1.56	ns
SILSTR	0.99	ns	0.52	ns	-2.08	**	-2.26	ns	-0.99	ns	1.57	ns
HYDSTR	1.38	ns	0.81	ns	2.58	**	-1.11	ns	1.26	ns	0.67	ns

Note: *p < .10; **p < .05; ns not significant

NSW	Positive scores on all scales except ECOL, NUTRIN, PSTSTR, WLDSTR, REGSTR
ACT	Positive scores on all scales except PSTSTR
VIC	Positive scores on all scales except ECOL, LANDSC, LNDSTR, PSTSTR, REGSTR, HYDSTR
QLD	Positive scores on all scales
SA	Positive scores on all scales except LNDSTR, WLDSTR
WA	Positive scores on all scales except AMBIA, ECOL, SILSTR
TAS	Negative scores on AMBIA, ECOL, NUTRIN, ECOEFF, HYDEFF, LNDSTR, PSTSTR, WLDSTR, REGSTR, SILSTR, HYDSTR; positive scores on HYDROL, LANDSC

MANAGERIAL FUNCTION

A comparison of 'managerial' foresters in New South Wales with those in each of the remaining States shows there are more similarities than differences between the foresters in these States (Table 10.6). A.C.T., Victorian, Queensland and Tasmanian managerial foresters have few differences from those in N.S.W. An exception to the pattern of similarity is Western Australia, where 'managerial' foresters differed from those in N.S.W. having more negative scale means (less agreement) on the four cognitive scales and the ECOEFF scale (positive t values). However, on the LNDSTR and HYDSTR scales, Western Australian foresters have positive mean scores, and less favourable attitudes (negative t values).

The South Australian 'managerial' foresters had no significant differences from those of N.S.W. foresters on seven scales. On those scales where there were differences, foresters in S.A. had higher levels of agreement that effects were serious or greater protection was needed.

Foresters within the 'research' and 'managerial' groups are much more alike within the groups than they are to each other. These two groups, in fact, differed significantly on 8 of the 13 scales (Table 9.6). Anderson et al (1982) also illustrate this, when they found medical students were more alike across universities than they were to students of other faculties of the same university.

TABLE 10.6

Comparison of 'managerial' foresters in N.S.W. with those in the other States

SCALE	A.C.T. (x-NSW)		VIC. (NSW-x)		QLD (NSW-x)		S.A. (NSW-x)		W.A. (NSW-x)		TAS (NSW-x)	
	t	p	t	p	t	p	t	p	t	p	t	p
AMBIA	1.07	ns	-0.48	ns	-0.32	ns	-0.18	ns	1.89	*	-0.08	ns
HYDROL	1.57	ns	1.15	ns	-1.10	ns	-0.16	ns	1.77	*	-0.67	ns
ECOL	1.40	ns	0.29	ns	-0.69	ns	-0.56	ns	1.85	*	-0.06	ns
NUTRIN	1.06	ns	-0.53	ns	-0.06	ns	-2.21	**	2.48	**	-0.36	ns
ECOEFF	3.86	***	-1.35	ns	-0.38	ns	-2.37	**	3.74	***	0.05	ns
HYDEFF	2.12	ns	-0.05	ns	0.11	ns	-2.12	**	1.49	ns	-0.73	ns
LANDSC	1.05	ns	-1.04	ns	1.58	ns	1.24	ns	1.20	ns	0.09	ns
LNDSTR	1.18	ns	-2.08	**	-0.13	ns	1.07	ns	-2.47	**	-1.88	*
PSTSTR	1.55	ns	0.52	ns	-1.20	ns	-2.12	**	-0.53	ns	-0.87	ns
WLDSTR	1.96	*	-2.26	**	-1.29	ns	-1.76	*	-1.49	ns	-0.93	ns

TABLE 10.6 (contd.)

SCALE	A.C.T. (x-NSW) t	p	VIC. (NSW-x) t	p	QLD (NSW-x) t	p	S.A. (NSW-x) t	p	W.A. (NSW-x) t	p	TAS (NSW-x) t	p
REGSTR	0.94	ns	-0.84	ns	1.26	ns	-2.26	**	-1.28	ns	0.32	ns
SILSTR	2.30	**	-0.21	ns	-3.12	***	-1.64	ns	2.82	**	0.65	ns
HYDSTR	0.87	ns	-0.29	ns	-1.84	*	-1.40	ns	-2.48	**	-0.39	ns

Note: *$p < .10$; **$p < .05$; ***$p < .01$; ns not significant

NSW All scales have negative means; ACT All scales have positive means

VIC All scales negative except AMBIA, LANDSC, LNDSTR, WLDSTR

QLD negative means: NUTRIN, ECOEFF, HYDEFF, LANDSC, LNDSTR;
positive means: AMBIA, HYDROL, ECOL, PSTSTR, WLDSTR, REGSTR, SILSTR, HYDSTR

SA Positive means: ECOL, NUTRIN, ECOEFF, PSTSTR, WLDSTR, REGSTR, SILSTR, HYDSTR
Negative means: AMBIA, HYDROL, LANDSC, LNDSTR

WA Negative means: AMBIA, HYDROL, ECOL, NUTRIN, ECOEFF, HYDEFF, LNDSTR, SILSTR;
Positive means: LNDSTR, PSTSTR, WLDSTR, REGSTR, HYDSTR

TAS All scales negative means except HYDROL, LNDSTR, PSTSTR

Foresters within the 'managerial' groups are also exhibiting the effects that a similar social environment would produce. That this social environment differs from that experienced by 'research' foresters is illustrated by the large number of differences between 'managerial' and 'research' foresters (Table 9.6).

PRODUCTION FUNCTION

A comparison of 'production' foresters in N.S.W. with those in the other States (Table 10.7) shows greater differences in attitudes occur than there are among 'research' or 'managerial' foresters, but nevertheless, on many scales there are no major differences.

While Tasmanian, Victorian and Queensland 'production' foresters do not differ on half or more of the scales, 'production' foresters in the A.C.T. differed on most scales (Table 10.7). The W.A. 'production' foresters agreed that effects were more serious than those foresters in N.S.W and differed on most scales. However, comments made by foresters to such items suggested they believed the effects were less serious in their own State.

Western Australian 'production' foresters are more committed to clearcutting, having less agreement that alternatives to clearcutting are suitable than their N.S.W. counterparts. However, the former accept that environmental protection could be improved, differing significantly from N.S.W. on the conative scales. This

TABLE 10.7

Comparison of 'production' foresters in N.S.W. with those in the other States

SCALE	A.C.T. (x-NSW) t	p	VIC. (NSW-x) t	p	QLD (NSW-x) t	p	S.A. (NSW-x) t	p	W.A. (NSW-x) t	p	TAS (NSW-x) t	p
AMBIA	1.60	ns	0.64	ns	-0.92	ns	-1.35	ns	+0.26	ns	-0.24	ns
HYDROL	1.55	ns	1.61	ns	-0.56	ns	-1.94	*	0.40	ns	-1.35	ns
ECOL	2.33	**	0.24	ns	-2.93	***	-2.40	**	-1.32	*	-2.89	***
NUTRIN	4.47	***	-0.46	ns	-0.57	ns	-6.16	***	-1.74	**	-0.63	ns
ECOEFF	3.28	***	-1.23	ns	-2.23	**	-3.42	***	-2.37	**	-1.52	ns
HYDEFF	2.88	***	-0.70	ns	-2.38	**	-5.57	***	-2.66	*	-1.82	*
LANDSC	3.03	***	-1.74	*	-0.69	ns	-0.84	ns	-3.71	***	-2.35	**
LNDSTR	2.14	**	-0.55	ns	-0.38	ns	1.03	ns	-1.87	*	-0.14	ns
PSTSTR	3.65	***	-0.31	ns	-0.86	ns	-1.97	*	-1.73	*	-1.67	*
WLDSTR	2.58	**	-0.81	ns	1.26	ns	-1.70	ns	-1.97	*	1.74	*

TABLE 10.7 (contd.)

SCALE	A.C.T. (x-NSW)		VIC. (NSW-x)		QLD (NSW-x)		S.A. (NSW-x)		W.A. (NSW-x)		TAS (NSW-x)	
	t	p	t	p	t	p	t	p	t	p	t	p
AREGSTR	2.03	**	-2.56	**	0.04	ns	-1.38	ns	-3.39	***	0.02	ns
SILSTR	4.17	***	2.08	**	-0.29	ns	-2.95	***	2.75	***	2.21	**
HYDSTR	3.07	***	2.67	***	-0.65	ns	-1.73	*	-4.35	***	0.87	ns

Note: *$p < .10$; **$p < .05$; ***$p < .01$; ns not significant

NSW	All scales negative means
ACT	All scales positive means
VIC	All scales negative except REGSTR
QLD	All scales negative except ECOL, ECOEFF, HYDEFF
WA	negative means: AMBIA, HYDROL, ECOL, NUTRIN, SILSTR positive means: ECOEFF, HYDEFF, LANDSC, LNDSTR, PSTSTR, WLDSTR, REGSTR, HYDSTR
TAS	Negative means: AMBIA, NUTRIN, ECOEFF, HYDEFF, LNDSTR, WLDSTR, REGSTR, SILSTR, HYDSTR positive means: HYDROL, ECOL, LANDSC, PSTSTR
SA	All scales positive except LANDSC, LNDSTR

difference may be the result of important differences between these two States in coupe size, retention of growing stock within coupes, intensity of post-logging burns and the environmental protection requirements and controls imposed. Coupe sizes are larger in W.A. than N.S.W., and cutover coupes look more like clearfelled areas than in N.S.W. where 25 percent of tree cover often remains. Environmental protection could thus be of greater importance in Western Australia.

The effect of territory is evident by the differences between A.C.T. and S.A. 'production' foresters and their N.S.W. counterparts. Both of these States' foresters are less favourable towards clearcutting than are those in N.S.W., thus exhibiting the effect of social environment shown in Chapter 6. However, there are no eucalypt forests managed for wood production in these States.

The greater number of significant differences between the 'production' foresters in each State and those of N.S.W. amplifies the possibility that distinct social 'micro' environments develop where specific practices take place. Distinctive attitudes may be associated with specific practices, and it seems the closer a group's involvement is with the actual practices, or the more important certain activities are to the group, the more likely the group is to develop specific attitudes in response.

Even among the four 'clearcutting' States, there are significant differences in 'production' foresters' attitudes, which are not so apparent among the research and managerial foresters in these States. However, in spite of these differences, there are many scales on which 'production' foresters do not differ.

However, because 'production' foresters are most directly involved with forest operations, the strong effect of direct experience (Table 8.1) is more likely to be evident among those foresters when compared between the 'clearcutting' and 'non-clearcutting 'States than among the other groups. Nonetheless, the general similarity of a production social environment among 'production' foresters is associated with similarity in their attitudes, and major differences from other foresters, such as those in research.

ADMINISTRATIVE FUNCTION

There are few differences in attitudes between the 'administrative' foresters in N.S.W. and the other States (Table 10.8). Most differences occurred between the A.C.T. and N.S.W. Foresters in administrative positions in the A.C.T. are exhibiting the effect of residence in a 'non-clearcutting' State, and have less favourable attitudes towards clearcutting than 'administrative' foresters in N.S.W. Although the Victorian and Queensland 'administrative' foresters also have less favourable attitudes than the N.S.W. foresters,

TABLE 10.8

A comparison of 'administration'
foresters in N.S.W. with those in the other States

SCALE	A.C.T. (x-NSW)		VIC. (NSW-x)		QLD (NSW-x)		S.A. (NSW-x)		W.A. (NSW-x)		TAS (NSW-x)	
	t	p	t	p	t	p	t	p	t	p	t	p
AMBIA	0.44	ns	0.41	ns	-1.36	ns	-0.32	ns	0.02	ns	-	-
HYDROL	2.22	*	-0.74	ns	-3.03	**	-	-	-0.26	ns	-	-
ECOL	0.74	ns	-0.71	ns	-1.08	ns	-	-	-0.31	ns	-	-
NUTRIN	2.69	**	0.04	ns	-1.03	ns	-	-	-0.93	ns	-	-
ECOEFF	3.32	***	-0.78	ns	-1.30	ns	-	-	0.80	ns	-	-
HYDEFF	3.94	**	1.28	ns	-1.89	*	-	-	-0.35	ns	-	-
LANDSC	2.71	**	-0.79	ns	-1.23	ns	-	-	-0.56	ns	-	-
LNDSTR	2.03	*	-0.88	ns	0.42	ns	-	-	-0.41	ns	-	-
PSTSTR	1.72	ns	-2.36	**	-2.75**		-	-	-3.29	**	-	-
WLDSTR	1.23	ns	-0.41	ns	-1.47	ns	-	-	-1.71	ns	-	-

TABLE 10.8

SCALE	A.C.T. (ACT-x)		VIC. (NSW-x)		QLD (NSW-x)		S.A. (NSW-x)		W.A. (NSW-x)		TAS (NSW-x)	
	t	p	t	p	t	p	t	p	t	p	t	p
AREGSTR	2.40	**	-2.75	**	-2.94	**	-	-	-2.15	*	-	-
SILSTR	2.89	**	-1.97	*	-2.11	*	-	-	-1.28	ns	-	-
HYDSTR	2.51	**	-1.41	ns	-2.50	**	-	-	-3.02	**	-	-
	4 ns		9 ns		9 ns							

Notes: *p < .10; **p < .05; ***p < .01; ns not significant

South Australia, W.A. and Tasmania had too few foresters in this group to make valid comparisons.

ACT	All scales positive means (less favourable attitudes)
NSW	All scales negative except AMBIA (more favourable attitudes)
VIC	All scales positive except NUTRIN (less favourable attitudes)
QLD	All scales positive except LNDSTR (less favourable attitudes)

they are not sufficiently different from N.S.W. foresters to generate statistical differences.

Overall there were more agreements than disagreements between N.S.W. 'administrative' foresters and those in the other States, suggesting that a similar social environment exists for the 'administrative' foresters in their work settings. This could be described as a social 'micro' environment occurring within bureaucratic organizations.

The nature and existence of a 'micro' environment within administrative settings has been suggested many times in organization literature, and such environments have generally been labelled the 'bureaucratic' (March and Simon, 1958).

Similarity exists in the social environment for 'administrative' foresters in terms of decision-making and a tendency to belong to conservation organizations, and this similarity is associated with similar attitudes between N.S.W., Victorian and Queensland foresters. Most 'administrative' foresters in the A.C.T. work in research or Government departments, and are not associated with eucalypt forestry in the same way as their counterparts in State forest servicesx Thus, we might expect them to have less favourable attitudes than their counterparts in the other States'.

SUMMARY

Foresters' attitudes vary according to their functional activities within the profession. These attitudes are related to the involvement of each group in policy formulation and decision-making (Table 10.2) and to the participation of each group in the conservation movement (Table 10.4). Variation in these conditions corresponds to social gradients along which the social environment varies. Social environmental gradients are associated with gradations in attitudes.

Social 'micro' environments may be associated with different functions, generating similarity in attitudes among those engaged in the same function. Mullins (1976) and Anderson et al (1982) suggest a similarity in attitudes among members of various professions. Research foresters across Australia show similarity in attitudes (Table 10.5), as do those in the 'managerial' (Table 10.6), production (Table 10.7) and 'administration' groups (Table 10.8).

However, there are distinct differences between some of the groups. 'Managerial' and 'research' foresters differed on eight scales, and 'production' and 'research' foresters on ten (Table 9.6). These results suggest that complex social and environmental factors underly attitude formation within groups, which cannot be explained by attitude-behaviour consistency or group attitudes alone.

Chapter 12 develops a social and ecological model which may provide some insight into attitude variations among foresters, improve our understanding of attitude formation among social groups, and suggest some reasons for variations between social groups.

CHAPTER 11

FOREST WORKERS' BELIEFS ABOUT CLEARCUTTING EFFECTS

Foresters in the 'production' and 'managerial' groups are more likely to support clearcutting operations than those in 'administration' or 'research'. Moreover, more favourable attitudes stem from a number of factors, including a more direct association with clearcutting operations, and a greater sense of identity with, or potential to influence, policy decisions.

Against this background, it was decided to examine the attitudes of a non-professional group, the loggers and associated workers who are engaged in clearcutting operations. This group has the most direct contact with operations and whose livelihood depends directly on them. In this respect, they might be expected to be particularly favourable towards clearcutting, to rationalize these activities, and thus reduce 'dissonance'.

At the same time, this group would have little if any, identity with, or influence upon, forest policy and management decisions; it seemed possible this might modify the strength of their responses. This survey was undertaken to explore such propositions, particularly as any differences in attitudes between foresters and forest workers could affect the smooth and efficient operation of the forest industry.

This chapter describes a field survey of loggers and other workers associated with clearcutting programs in New South Wales (N.S.W.) and Western Australia (W.A.).

THE SURVEY

The survey was based on the same issues presented to foresters, but in a different format because of differences in education and the work environment. A separate questionnaire was devised, containing fewer questions, different wording, but nevertheless a similar scaling method for responses (see sleeve insert Appendix B). These differences, however, precluded any direct statistical comparison on specific items between foresters and forest workers.

Before entering the forest, a talk about the nature of the research and the issues to be covered in the questionnaire was given to contractors at Eden, N.S.W. Then with the consent of logging contractors, the questionnaire was given to workers to complete at work areas in the forest. The co-operation of the N.S.W. Forestry Commission and Harris-Daishowa Ltd. was also obtained.

Similarly, in Western Australia, Bunnings Ltd and the W.A. Forest Department agreed to cooperate. Finally, as the questionnaires were to be completed in the forest, the co-operation of each logging crew was obtained.

Six crews were visited in W.A. in the Pemberton, Deanmill and Shannon areas. Fifteen crews were visited in the Eden-Bombala district N.S.W. In total, 111 questionnaires were completed by tree-fellers, skidder drivers, dumpmen, dozer drivers, contractors and foremen.

ATTITUDE VARIATION AMONG FOREST WORKERS

Items covered the same six broad areas of concern as presented to foresters (Table 2.3). Factor scores based on the same analysis applied to foresters' raw scores could not be calculated for forest workers' responses, because items were not presented to forest workers in the same format or wording. In simplifying the questionnaire, and with different wording, some items indicated more favourable attitudes with increasing scores, while others indicated less favourable attitudes with increasing scores. All items presented to foresters indicated less favourable attitudes with increasing scores.

The results of this survey are summarised in Table 11.1, where the mean responses of all workers in W.A. are compared with those of all workers in N.S.W.

The categories within each item were much the same as those used for foresters, with a value range of 1 to 5 for most items, but 1 to 4 for others (see questionnaire).

TABLE 11.1

Comparison of Western Australian and New South Wales forest workers

QUESTIONNAIRE ITEM	FOREST WORKERS N.S.W. MEAN	W.A. MEAN	t	p	MEAN AGREEMENT LEVEL TO ITEM
Long term scenery changes following logging	2.23	1.95	1.74	*	more attractive
Same timber species regenerating	2.07	2.05	0.31	ns	much the same
Soil compaction in forest	1.88	2.20	-1.89	*	not much
Regeneration affected by soil compaction	1.84	1.84	0.02	ns	not much
Native animals present before logging	1.71	1.84	-0.80	ns	not many
Change in numbers of animals after logging	3.46	3.19	1.16	ns	no change in numbers
Species survival affected following logging	1.88	1.65	1.73	*	not many affected
Recreation use before logging	1.65	1.37	1.56	ns	not at all - not much
Change in recreation use after logging	2.91	2.72	0.81	ns	moderate increase
Soil erosion following logging	2.58	1.86	3.28	***	small-moderate increase
Loss of topsoil following logging; effect on regrowth	2.00	1.86	0.65	ns	not much
Water quality effects following logging	1.75	1.81	-0.30	ns	not much
Timber volume change over rotation	2.74	2.53	0.75	ns	no change

TABLE 11.1 (continued)

Are increased wood quotas possible?	3.17	2.74	1.84	*	somewhat
Are costs of protection justified?	3.19	3.14	0.20	ns	somewhat
Important to separate coupes	3.00	3.00	0.00	ns	somewhat important
Machine operation effects on soil	2.71	2.72	-0.05	ns	not much
Are drainage requirements adequate?	2.22	2.11	0.99	ns	requirements adequate
Are regulations reasonable?	3.20	3.60	-2.37	**	somewhat - very
Are forestry officers in bush sufficiently?	3.17	3.34	-1.03	ns	somewhat - a lot
Is enforcement of regulations fair?	2.97	3.46	-2.58	**	somewhat - very much
Should hollow trees be left?	2.72	1.88	4.36	***	only non saw-pulp logs
Are there enough wildlife reserves?	2.30	2.16	1.43	ns	about right
Do different machines have different impacts?	2.86	3.14	-1.45	ns	somewhat
Is supervision of inexperienced operators adequate?	2.72	2.44	1.87	*	about right
Is contact with supervisors sufficient?	2.72	2.44	1.87	*	about right
Any training in job	1.86	2.09	-1.93	*	some training
National Parks sufficient in Region?	2.70	2.56	1.29	ns	about right
Do regulations benefit industry?	3.33	3.51	-0.89	ns	somewhat - very much

Note: Mean agreement level corresponds to the response category on the questionnaire. Where a range is indicated, this corresponds to the range indicated by the different means of W.A. or N.S.W. forest workers.

The responses of logging workers in both States suggest a general belief that operations have limited effects on the forest.

Despite the major differences in the forest types, environmental controls and standards, and different approaches to forest operations, workers in W.A. and N.S.W. had major differences on only three of their responses to items. On the issue of soil erosion, N.S.W. forest workers believed more erosion resulted from clearcutting than did W.A. forest workers. This could be the result of differences in soil types; some of the granitic soils of the Eden, N.S.W. area being highly erodible. Also, N.S.W. operations are carried out in forests on steeper topography than in W.A. Workers in the two States also differed on the desirability of leaving hollow trees for wildlife. N.S.W. forest workers believed more trees should be left than did the W.A. forest workers. In N.S.W. there is a greater emphasis on retaining wildlife habitat trees than in W.A., and forest workers in N.S.W. appear committed to that principle. Both groups commented that retention of large hollow trees was dangerous because of the protection lost for the trees when a stand is felled.

New South Wales workers were concerned about fire protection and believed it was 'not very adequate', while the W.A. group was less concerned. This difference may have resulted because W.A. has a highly organised aerial fire surveillance and protection system. Neither group, however, believed fire protection was totally adequate.

The W.A. and N.S.W. workers differed on less than half of the issues (Table 11.1) having similar levels of agreement with the remaining. Thus, workers from both States believed the same timber species were replacing old forests, that regeneration was not affected by soil compaction, and that wildlife was not dramatically affected by logging operations, among others.

On issues where there were differences, such as scenery impacts, machinery compaction or enforcement of environmental guidelines, those differences could be explained on the basis of differences in coupe sizes, soil and topography, and environmental protection guidelines.

The general similarity in attitudes between W.A. and N.S.W. workers supports the proposition that similar role settings or 'micro' environments generate similar attitudes. Because of their close association with actual forest operations, it might be expected that forest workers are motivated to develop attitudes consistent with their forest activities. Thus, we might expect these workers to be favourable towards clearcutting, as their livelihood depends directly on their activities in the forest.

However, while all the responses of the forest workers were in a direction favourable towards clearcutting, there were individual gangs having either more strongly favourable, or alternatively, more strongly 'environmentalist' views.

VARIATION BETWEEN FOREST WORKERS AND PRODUCTION AND MANAGERIAL FORESTERS

Two occupational groups within the profession are particularly favourable towards clearcutting; the 'managerial' and 'production' foresters (Chapter 9). As the 'production' foresters are closest to the forest, with 69.5 percent of respondents involved in field operations and supervision, we might expect their responses to be similar to those of forest workers.

A comparison of the level of responses by forest workers and foresters to the items related to the main issues of concern is shown in Table 11.2.

Responses of both foresters and forest workers to items related to landscape effects show that both groups have similar beliefs about such effects. On the issue of wildlife effects, 'production' and 'managerial' foresters were more willing to accept there were adverse effects on wildlife. In neither State did forest workers consider there were many animals in the forest before logging, or that there was any change in population numbers after logging. Both 'production' and 'managerial' foresters believed native species would be 'somewhat' reduced.

Forest workers, however, agreed that soil erosion was more likely than did foresters in the two

TABLE 11.2

A comparison of production and managerial foresters with forest workers: items related to the effect of clearcutting on the forest environment

ENVIRONMENTAL EFFECT OF CLEARCUTTING	LEVEL OF RESPONSE MANAGERIAL	PRODUCTION	FOREST WORKERS
LANDSCAPE EFFECTS			
Landscape appeal reduced	not much	not much	-
Long term changes to scenery	not much	not much	more attractive
RECREATION			
Reduction in recreation settings	somewhat	somewhat	-
Current level of use of forest	-	-	not at all - not much
Increased use after logging	-	-	moderate increase
WILDLIFE EFFECTS			
Populations of canopy dwellers affected	not much	not much	-
Reduction in populations	somewhat	somewhat	-
Populations present before logging	-	-	not many
Change in populations after logging	-	-	no change
Species diversity reduced	somewhat	somewhat	-
Survival of species affected following logging	-	-	none at all affected
PLANT SPECIES EFFECTS			
Reduction in species diversity	not much	not much	-
Same timber species present in future	-	-	much the same
Long term changes to plant species composition	not much	not much	-
SOIL EROSION EFFECTS			
On stable soils	not much	not much	small - moderate increase
On unstable soils	somewhat	somewhat	-
WATER QUALITY			
Increase in sedimenttion	somewhat	not much	-
Effects on water quality	-	-	not much

groups. However, forest workers carry out many logging operations on steep slopes, unstable soils and over large areas of forest, and may be more aware of any soil erosion that does take place.

It appears that few real differences occur in the general attitudes of forest workers and 'managerial' or 'production' foresters. As no direct statistical comparison can be made here, there is little scope for interpretation of the data other than what can be drawn from Table 11.2.

As forest workers are closely involved with the forest, they have a commitment to their own actions, and would believe what they do is acceptable, to reduce inconsistency between attitudes and behaviour. The level of responses given by forest workers both in W.A. and N.S.W., also suggests a 'group attitude' has emerged. Thus, similarity in social environment through similar activities is again associated with similarity in attitudes.

The attitudes of 'production' and 'managerial' foresters also suggest the development of a similar 'group attitude' to that of the forest workers with respect to the issues canvassed. Managerial and 'production' foresters are responsible for policy decisions and would hold a degree of commitment to them. By identifying with these decisions, such foresters would find it necessary to support clearcutting activities, although they are not as actively involved as the forest workers.

A further and different explanation to the emergence of differences in attitudes between the four occupational groups in the profession is suggested in Chapter 12, and this explanation can also be applied to the attitudes of the forest workers.

As described in Chapter 9, there are marked differences in attitude between 'research' and 'production', and 'research' and 'managerial' foresters. As forest workers have similar attitudes to the 'production' and 'managerial' foresters, we would expect similar problems to arise between 'research' foresters and forest workers, as between 'research' foresters and these other foresters. Such a situation could generate difficulties in applying research findings in the field.

PART V

CHAPTER 12

ATTITUDE ADAPTATION AMONG AUSTRALIAN FORESTERS: A SYNTHESIS

Attitude-activity consistency and group attitude concepts go part of the way to explaining the attitude variation among foresters. We have seen that the attitudes of foresters with direct involvement in clearcutting are more favourable towards clearcutting than are those without direct involvement (Chapter 8). Such attitudes were explained by attitude-activity consistency concepts. The attitudes of foresters who belong to conservation organizations (Chapter 7) can be explained by group attitude concepts. We have seen in Chapter 6 that foresters in 'clearcutting' States are more favourable towards clearcutting than are those in 'non-clearcutting' States. Such variation was explained by combining attitude-activity consistency and group attitude concepts.

There is, however, variation in attitudes that cannot be explained adequately by these social psychology models. We have seen in Chapter 10 that the attitudes of foresters in the occupational groups are related to their potential access to decision-making within an organizational context.

Attitude-activity consistency and group attitude concepts can explain the attitudes held by the managerial or 'production' foresters. These concepts are inadequate to explain the gradation in attitudes among the occupational groups, to differences in access to decision-making.

These analyses suggest that a new element needs to be considered in terms of the activities of a social group in relation to attitudes. This element appears to be the relative importance of such activities to the social group or to their meeting organizational goals.

Access to decision-making corresponds to variation in the importance of decision-making activities to the group's general activities. Thus, 'managerial' and 'production' foresters have considerable involvement in decision-making activities, and such activities assume a high level of importance to them. On the other hand, 'research' and 'administration' foresters have much less involvement in decision-making activities, and such activities do not have a high level of importance to them.

It is hypothesised that the relative importance of some activity to a social group, in terms of meeting the group's or organizational goals, is important to determining the nature of attitudes that members of the group may hold to this activity or to other activities dependent on it.

It is proposed that attitudes develop among members of a social group not only in response to the need for attitude-activity consistency, but also to the functional importance of those activities to members of the group and their social survival. We will now consider an explanation that integrates these findings within the social and ecological context of this research.

In considering an integrated approach to explaining the variation in foresters' attitudes, the effects of an individual foresters' personality, life style or other environmental effects are not included, but it is recognised that these can affect individuals' attitudes; such is also evident by the variance in attitude scores not accounted for (Table 8.9). As a starting point we will consider how attitudes could assist in a group's social survival.

ATTITUDES AS SOCIAL ADAPTATIONS

The attitudes of foresters in the occupational groups showed gradual variation with variation in the importance of decision-making activities to the group. Involvement in decision-making activities generates social environmental conditions. Such conditions change as involvement in particular activities and their importance changes. Variation in social conditions could be described as a 'social environmental gradient'. Foresters' attitudes are shown to respond to such a gradient in decision-making in consistent ways (Chapter 10).

Before proceeding further, it would be useful to consider an analogy of the responses of biological organisms to environmental variation. When variations in environmental conditions produce differential responses by organisms, they are said to be producing an adaptive response to the particular environmental conditions they meet (Whittaker, 1975). We can argue that changing attitudinal responses to changing social conditions could likewise be adaptive responses to the particular social conditions being met. Thus, foresters are responding to their social environment by holding attitudes adaptive to the social conditions they encounter at the time, and in this way are responding to social environmental gradients in a similar way to the way biological organisms respond to environmental gradients. Attitudinal responses to variation in social environmental variation could thus be described as a process of social adaptation. It is suggested that attitudes adaptive for a social environment are dynamic, and would allow persons to have greater social 'survival' capacity in that environment, to be better able to cope with engaging in the activities of the group, and to be able to make decisions (in relation to those activities) consistent with the group's goals.

As an example, the attitudes of production and managerial foresters reflect an adaptive response to their positions in the organization, and the particular social environment in which they are required to work. In order for these foresters to maintain their effectiveness on the job, a high degree of loyalty to the organization would be required. To achieve consistency between behaviour and attitude would require the development of favourable attitudes towards organizational activities, which is illustrated in Chapter 9.

It is possible that foresters come to work in particular areas, such as production or managerial activities, because they already hold attitudes adaptive for such situations. Because we do not know their full social history, it is impossible to determine how or where they acquired such attitudes. We can say, however, that they would not remain unaffected by their current work environment, as the effects of social interactions would act to modify their attitudes closer to those of the majority of the group (Mead, 1967), thus placing an adaptive pressure on them. The effect of experience of clearcutting (Chapter 8) illustrates how attitudes might be modified by more opportunities to participate in a social environment.

However, a forester's work experience often follows a predictable sequence, with field work usually one of the first forestry tasks newly graduated foresters are given. Thus, the stimulus to acquire attitudes adapted to a production environment exists from an early point in many foresters' careers. Foresters who choose research activities on the other hand, may never be exposed to such production environments, and the data in Table 9.8 confirms this. Of the research foresters, 73 percent have had no management experience of clearcutting, and thus few have been exposed to the atittudes prevailing among the 'production' or 'managerial' foresters. The difference in attitude between research foresters and 'managerial' or 'production' foresters (Table 9.6) suggests that such lack of exposure to production oriented activities may be responsible for some of this attitude difference.

The greater a person's involvement in particular activities, the more we might expect their attitude to adjust to reflect a greater commitment to those activities. Involvement in activities important to the group may place an 'adapting' pressure on participating members so that attitudes become adaptive to the objectives of the group, or to the objectives of some higher organizational activity. Thus, foresters in conservation organizations hold attitudes adaptive to the objectives of such organizations, which may lobby for changes in forestry practices such as clearcutting.

We will now consider in detail the nature of concepts needed to explain the attitude variation among the occupational groups in terms of the emergence of socially adapted attitudes.

ATTITUDE ADAPTATION IN A HUMAN ECOSYSTEM

A first step to developing an integrated theory is to consider the process of attitude adaptation within the ecological framework utilised in this study.

Attitude adaptation could arise as the result of variation in social environmental conditions. A person experiences these environmental conditions through participation in activities or social interactions. Variation in the nature or importance of activities will generate variation in the environmental conditions experienced. Foresters in different occupational positions, for instance, have different involvement with actual forestry operations; production foresters having direct supervisory involvement, while research foresters have 'inquisitorial' involvement, each of which provides different experiences of such operations.

Variation in the nature of foresters' involvement in forestry activities produces variation in attitudes (Chapter 6 to 10). The nature of those attitude variations suggests that 'attitude gradients' have emerged. Thus, foresters' attitudes towards clearcutting vary from least favourable among those belonging to conservation organizations to most favourable among those belonging to the Institute of Foresters only, and are least favourable among 'administration' foresters to most favourable among 'production' foresters.

Such attitude gradients are associated with 'social environmental gradients'. Thus, increasing access to decision-making is associated with increasingly favourable attitudes towards clearcutting. It is suggested here that the attitude gradients reflect the attitudes adapted for the various social conditions arising along the social environmental gradient. These concepts are summarised in Figure 12.1 and are presented in more detail in Table 12.1.

The process of attitude adaptation described above results from variations in environmental conditions within the human ecosystem represented by the forestry profession interacting with the forest environment through clearcutting practices. The results of this study suggest that attitude adaptation could occur in any human ecosystem involving a social system interacting with an environment, such as persons in different socioeconomic classes participating in different parts of the education system, or industrialists and conservationists making different uses of a particular resource environment.

The concepts proposed in the integrated theory presented here draw on the results of the analyses of Chapters 6 to 10. More details of an integrated theory follow with a description of social environmental gradients.

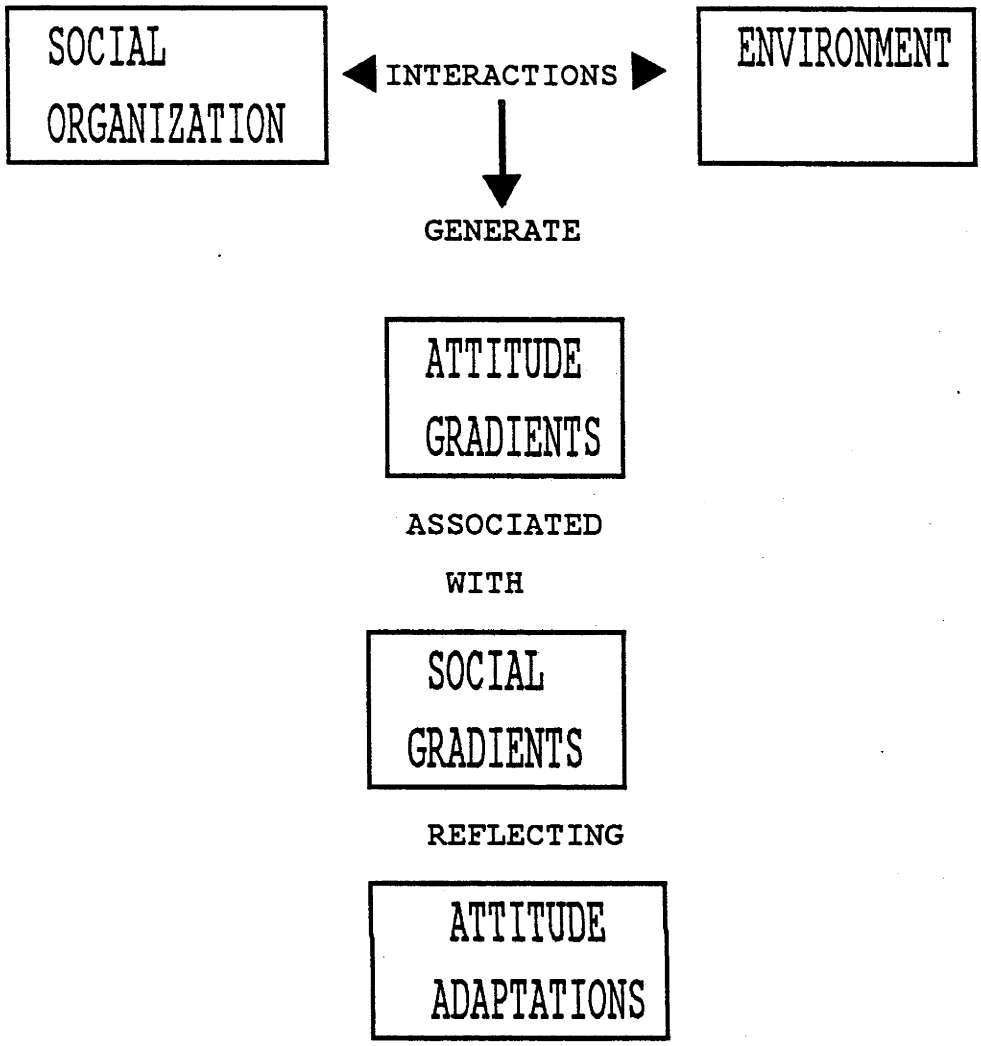

FIGURE 12.1

ATTITUDE ADAPTATION IN A HUMAN ECOSYSTEM

TABLE 12.1

Dimensions in the process of social attitude adaptation in a human ecosystem (the forestry profession in Australia)

DIMENSION IN MODEL	EXAMPLE OF DIMENSION
SOCIAL ORGANIZATION	The forestry profession in Australia
INTERACTING DIMENSIONS	
(a) A technology	The forestry practice of clearcutting eucalypts
(b) Other social arenas	Conservation and environmental organizations
(c) A resource environment	The eucalypt forests of Australia
SOCIAL ENVIRONMENTAL GRADIENTS	1. Variation in access to policy decisions related to a TECHNOLOGY: "power"
	2. Variation in membership of conservation organizations: 'environmentalism'
SOCIAL HIERARCHIES	Position along social environmental gradient

TABLE 12.1 (continued)

DIMENSION IN MODEL	EXAMPLE OF DIMENSION
ATTITUDE GRADIENT	Variation in attitudes towards clearcutting eucalypts along social environmental gradients.

Some of these dimensions are shown in Figure 3.3

'Social environmental gradients', 'social hierarchies' and 'attitude gradient' are added here to the model.

SOCIAL ENVIRONMENTAL GRADIENTS

Persons occupying different positions within a social organization have different interactions with social, physical or biological environments. An example of differences in social interactions between persons in different socio-economic positions has been shown in studies in language development, where variations in the social environment have been related to differences in attitudes towards intellectual achievement (Kagan, 1968; Cazden-Courtney, 1966; Finley, 1967). Similarly, variation in the nature of interactions of the functional groups within the forestry profession and the forest environment is apparent; for example, 'managerial' and 'production' foresters are involved in different types of decisions in relation to the forest from 'administration' and 'research' foresters, and make these decisions within different types of social environments, with differing expectations and responsibilities. Such variation in interactions is suggested in Figure 12.1 as a social gradient or social environmental gradient.

Social environmental gradients within the forestry profession are also related to social hierarchies (Chapter 10). A hierarchy of 'power' in decision-making corresponds to a social gradient of variation in involvement with decision-making activities. A social hierarchy describes the position of a group along a social environmental gradient, while the social environmental gradient describes the variation in environmental conditions.

A social gradient of variation in interactions with the conservation movement is related to a social hierarchy of 'environmentalism'. Management experience also generates a social gradient and thus a social hierarchy in which different persons and thus groups have different levels of experience along the gradient.

Social gradients and hierarchies occur within society in response to variations in social status and prestige, wealth, knowledge, power and even susceptibility to infectious disease (Suchman, 1968). These examples illustrate that variation in interactions between social groups and their environment are common, and lead to differences between the groups.

The social gradients within the profession are also related to systematic variation in attitudes (Chapter 10). Attitudes to clearcutting along the social gradient of 'power' in decision-making, for instance, range from the least favourable at the least 'power' end, to most favourable at the most 'power' end.

Along the social gradient of 'environmentalism', attitudes vary from most favourable at the least 'environmentalist' end to least favourable at the most. These variations suggest attitude adaptations along the social gradients.

Similarly, attitude adaptations occur under various social situations in response to variations in the social environment. Thus, variations in social interactions noted by Kagan (1968) form a social gradient of interpersonal social contact.

Kagan suggested that significant differences arose between the language skills of 'lower-middle class' and 'middle-class' children, which could be attributed in part to differences in direct social interactions between mothers and their children. Such variation in social interactions was associated with different attitudes towards intellectual achievement. An attitude gradient is apparent between the members of the socioeconomic 'classes', both with respect to intellectual achievement and to direct social contact with children. These attitudes could be seen as adaptations to prevailing social conditions, and are related to the position of each social 'class' in the social gradient.

Suchman (1968) also noted differences in the learning abilities of children from different social 'classes', which could be partly attributed to differences in the attitudes of parents and peer groups towards intellectual achievement. These attitudes were related to a social gradient associated with different socioeconomic conditions. The attitudes held by each group could be seen as attitude adaptations along the social gradient. Attitudes held by 'middle class' parents favoured intellectual achievement, which are adaptive to encourage academic pursuits in their children. Persons in 'lower class' groups were more concerned with survival, and had less favourable attitudes towards academic achievement, which were adaptive to surviving in a more work oriented environment.

Similar attitude variations between different social 'classes' have also been found in different cultures. For example, Sigel et al (1966) found similar effects to Kagan (1968) with negro children.

The model can be developed further by examining how attitudinal responses of social groups along a social gradient may be derived from ecological processes affecting persons and their social environment.

SOCIAL ENVIRONMENTAL GRADIENTS AND ECOLOGICAL PROCESSES

The 'interactions' of a social organization with social, physical and biological elements of the environment are ecological and dynamic in character, as is suggested by the examples in Figures 3.1 and 3.2, and the framework for this study (Figure 3.3). Attitudinal responses along social environmental gradients occur in response to variations in the nature of involvement in activities by the various parts of a social organization.

Among the forestry profession, foresters in research positions may have very few formal or informal opportunities to interact directly in policy or decision-making in relation to forest management, while managerial and production foresters have many. This social gradient reflects differences in opportunities to influence decisions about forest management policies.

Attitude adaptations occuring in response to social environmental variations show that attitude formation is a dynamic process, and in this context is ecological in character. While the social environment places adaptive pressure on attitudes, attitudes feedback into the social environment tending to change it.

The importance of ecological processes in the relations between social groups and their environment is now well established. Burch, (1977) noted the importance of an ecological understanding of human social behaviour. Ecological approaches to the study of the relationships of culture to ecosystem (Vayda, 1977) and the interaction between social structure and environmental change (Burch, 1971) illustrate the importance that ecological processes have when considering social and cultural problems. Some examples of applications of this approach are given in Machlis (1979) and Zimmerman (1981). Zimmerman's work showed that an ecological approach to a resource management problem related to petrol rationing, indicated the actual beneficiaries of a petrol rationing program, in contrast to the anticipated beneficiaries indicated by a demand-supply analysis.

Foresters' attitudes at each position along social gradients suggest that their attitudes adapt to the environmental conditions facing them at each point, or at least are not maladaptive. These attitudes have thus emerged through processes of inter-dependence between the activities associated with a position along a social gradient, and the environment in which these activities take place. With time, attitudes would become distinguished at each point along the social gradient, and the groups become segregated on their attitudes to some issues.

In the next section we take this model further by examining the nature of attitudes along social gradients.

RELATIONSHIPS BETWEEN ATTITUDES AND SOCIAL ENVIRONMENTAL GRADIENTS

The Direction of Attitude Gradients

We can examine attitude variation along social environmental gradients utilising the data in Chapter 10. These show the nature of gradients in attitudes related to variation in decision-making among foresters. The first characteristic of attitude gradients to consider is the direction of the gradient.

An attitude gradient can be either positive or negative depending on the nature of attitude variation along an environmental gradient. A positive attitude gradient would occur where an increasing position in a social hierarchy is associated with an increasing score on an attitude scale.

The meaning of an attitude score will depend, however, on the nature of the scales used and the nature of the attitude under study. The nature of attitude gradients can be expressed in many ways: for example, an attitude gradient has been shown in Chapter 10 in relation to the numbers of foresters within each functional group who are also members of conservation organizations. This gradient is positive.

In order to illustrate this concept in more detail, and to indicate where gradients between the functional groups change, the attitude gradient associated with access to decision-making will be utilised. The data presented in Chapter 9 for attitude scores and the functional groups is plotted by position in the social hierarchy related to decision-making. As mentioned previously, this social hierarchy is derived from the social environmental gradient associated with decision-making between the groups.

The general direction of the attitude gradient is indicated by a dotted line in Figure 12.2 to 12.4. The solid line indicates the specific change in attitude between each group shown. Figure 12.2 illustrates the cognitive scales, figure 12.3 the affective scales, and Figure 12.4 the conative scales. The attitude gradient is negative for this example.

As Table 8.9 shows, management experience has a negative relationship with attitude scores. Thus, attitudes become more favourable towards clearcutting with increasing experience of clearcutting. If the functional groups are ranked according to management experience (Table 9.8), and the mean attitude scores plotted against the position of the functional groups in terms of management experience, a negative attitude gradient also occurs.

In the attitude scales used in this thesis, increasing and positive scores mean an increasing belief that effects are probable, increasing concern that effects are serious, and increasing belief that environmental protection is inadequate. The higher and more positive the score, the more unfavourable the attitude towards clearcutting in general. Greater

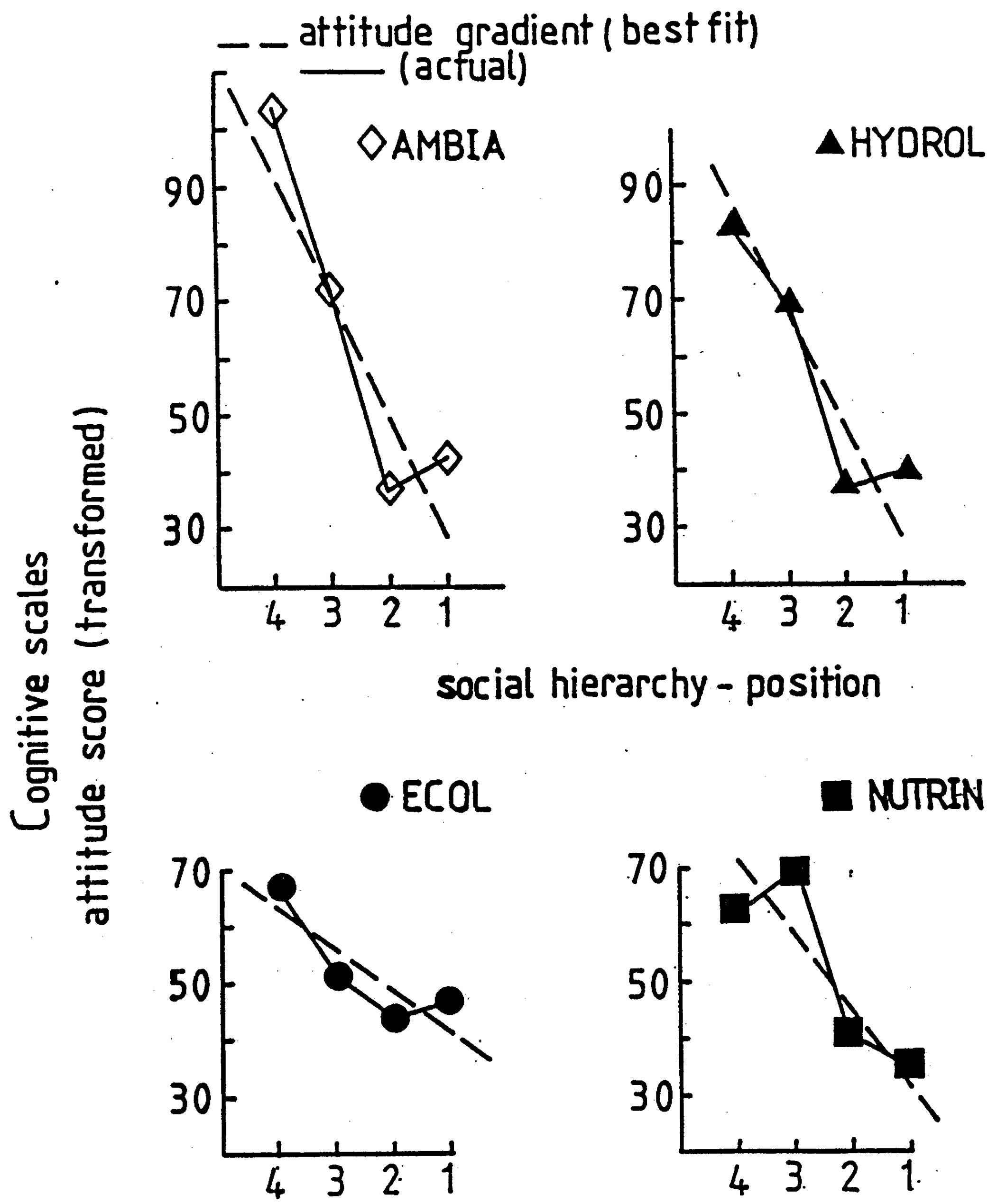

FIGURE 12.2

ATTITUDE GRADIENTS: DECISION-MAKING HIERARCHY

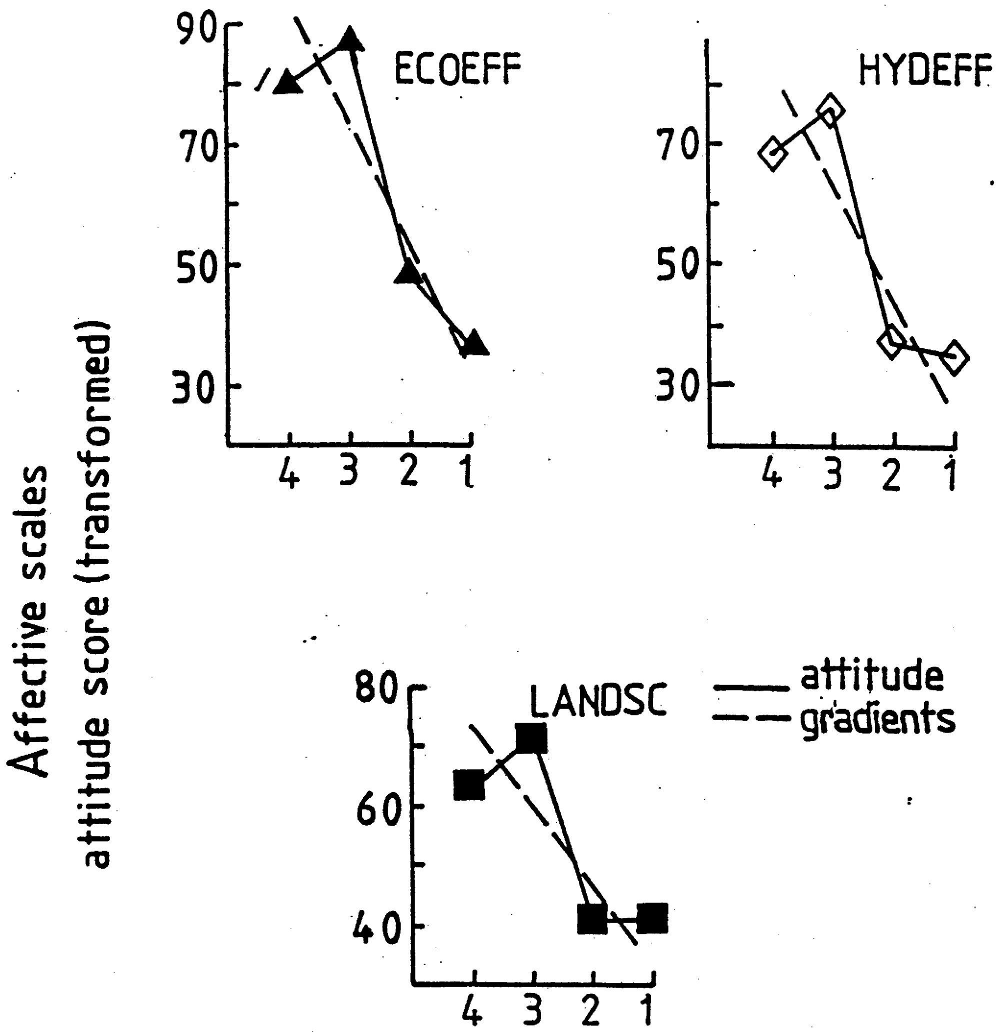

FIGURE 12.3

ATTITUDE GRADIENTS: DECISION-MAKING HIERARCHY

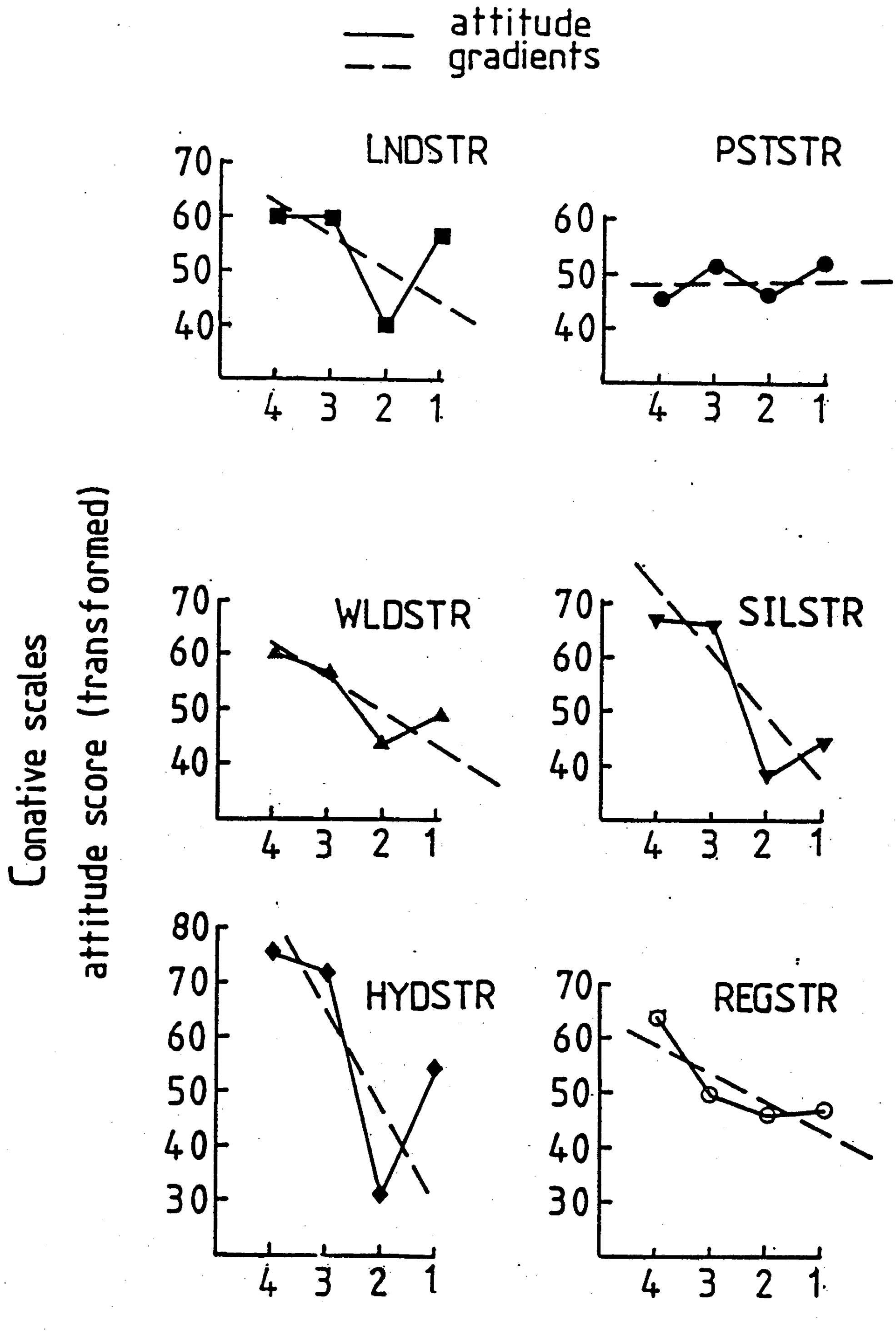

FIGURE 12.4

ATTITUDE GRADIENTS: DECISION-MAKING HIERARCHY

agreement with items reflected less support for clearcutting.

The nature of attitudes that are adaptive for the groups most involved in relevant activities within a social hierarchy determines the direction of the attitude gradient. Thus, attitudes vary from support of clearcutting among foresters with considerable influence in decision-making, to unsupportive where there is little, if any influence, thus generating the negative attitude gradient illustrated in Figures 12.2 to 12.4 for all attitude scales.

It is adaptive for managerial and production foresters to believe there is little probability of effects from clearcutting, and that there is less need for concern about them. This would reduce inconsistency between attitudes and activities, providing a rationalization and justification for decisions with which they may be involved. Research foresters do not need to support clearcutting to justify such operations. Thus, they experience no social pressure to adapt their attitudes.

Variation in social environments has led managerial and production foresters to diverge in attitude from the remaining foresters. This suggests that the social gradient is exerting pressure on foresters to modify their attitudes in an adaptive way.

Administrative foresters have the most environmentally oriented attitudes, with the most positive scores on 7 out of 13 scales. We could speculate on why this has occurred. First, there could be a need to find some form of escape from a regimented bureaucratic environment where there is no direct 'line' responsibility for organizational decisions. Administrative activities offer the least opportunity for self direction in the work environment (Miller, 1946). Membership of an active 'environmentalist' organization outside the Institute of Foresters could provide some diversion from unsatisfactory work activity, or 'compensate' for lack of professional fulfillment in the work environment. It is, however, beyond the scope of this study to test this proposition.

Foresters in general may join environmentalist organizations for a number of reasons, such as a general interest in conservation issues, association with other members, or the influence of the social environment in which they work. Forester members may also leave these organizations if there is too much cross pressure from their working environment. Again empirical examination of this is beyond the scope of this study.

The Slope of Attitude Gradients

The slope of an attitude gradient shows two things. First it indicates the degree of similarity in the attitudes of groups, and second, the degree of similarity in the social environment. These effects are illustrated in Figure 12.5.

Figure 12.5 shows that the attitudinal responses A and B, A' and B', and A" and B" correspond to the same relative position in a social hierarchy. The difference in these responses is related to the variation in social environment experienced by persons in different positions of a social hierarchy. Where attitude differences are greatest, (A" and B"), this suggests the greatest difference occurs in the social environment experienced within the social hierarchy. Thus, the slope of the attitude gradient is steepest.

If we found large differences in attitudes among social groups, we might want to look at the variations in the social environment to locate the potential source of these differences. Conversely, if we look at groups with very different environments, such as slum dwellers, high rise apartment dwellers or mansion owners, we might expect to find large differences in their attitudes to social issues such as tax evasion or tax deductions, social security eligibility for unemployment benefits or many other issues. These propositions could be tested by further appropriate research.

It would be an advantage to be able to predict the responses of different social groups to initiatives in government policies, social policy, law reform, environmental and other issues. An understanding of the interrelationships between social environment variation and attitudes provides a basis for further work in this area.

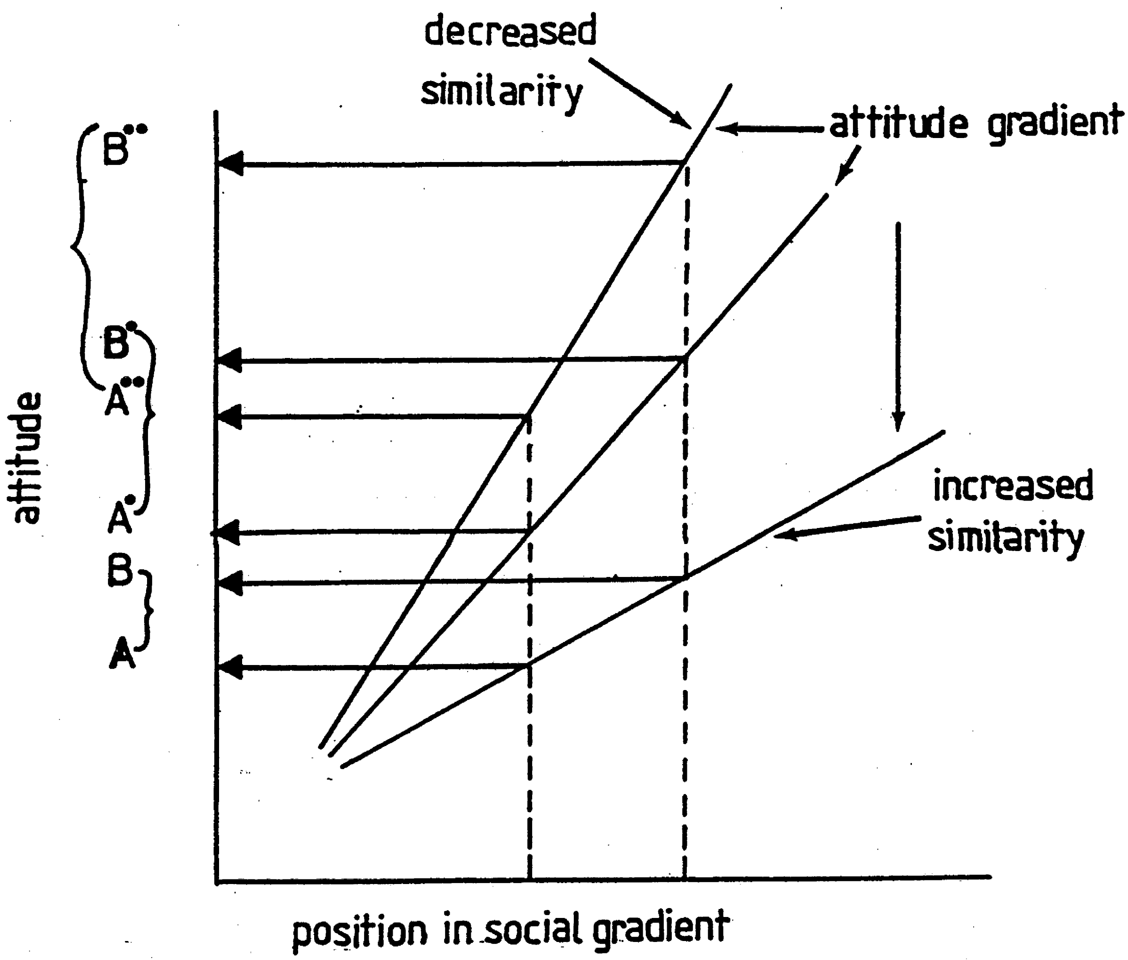

FIGURE 12.5

SIMILARITY IN SOCIAL ENVIRONMENT AND ATTITUDES

As an example of attitude variation within the forestry profession, the slope of the attitude gradient for the AMBIA scale (Figure 12.2) is one of the steepest among all scales, confirming large differences in attitude, and little similarity in the social environment between the groups for these issues. In contrast, the slope for the WLDSTR and REGSTR scales (Figure 12.4) is much less, suggesting much smaller differences in attitudes and social environment between these groups on those issues.

Attitudes become more divergent as differences in the environments of groups become more pronounced. This situation could lead to conflict and disagreement between groups occupying different positions along a social environmental gradient.

The responses of the functional groups on the PSTSTR scale (Figure 12.4) provide an example of considerable similarity in attitude between foresters in different positions along the 'power' gradient, i.e. the attitude gradient is small. Such similarity suggests that a social environmental gradient has not developed in response to the issues of pest and disease problems. The responses of foresters suggest that all groups are in favour of some improvement in protection, although most groups were around the centre of the scale in their responses (i.e. indicated somewhat).

It may be that most foresters in field and managerial positions, who might have been expected to differ from the other foresters, have not been exposed to specific situations or activities related to pest and disease problems, or that there are no major problems, so that there are few major differences between the four groups in the social environment surrounding these issues. Thus, there is less need for 'managerial' and 'production' foresters to hold 'justifying' attitudes, and consequently their attitudes are similar to the research and administrative foresters on these issues.

The greatest similarity in attitudes in the profession occurs within the 'production' and 'managerial' groups (Table 9.6). This is illustrated by the close proximity of these groups on the attitude gradient (Figure 12.2, 12.3 and 12.4). The wider differences on the conative scales (Figure 12.4) suggests that production foresters do differ in the way they would alleviate environmental problems. This greater difference is illustrated by a steeper attitude gradient between the groups.

Both these groups are in 'line' positions of responsibility for forest management decisions, thus the potential for similarity in the social environment exists. That this social environment has become significantly different from that of the 'administrative' and 'research' groups is evident by the large gap in attitudes between the 'line' groups and the 'non-line' groups. (See also Figure 9.3).

CONVERGENCE IN ATTITUDES

Similar attitude adaptations are predicted to occur under similar social environment conditions. Thus, 'research' foresters in all States should exhibit similar attitudes, as should the 'managerial' and 'production' foresters. This proposition is in fact illustrated by the analyses of Tables 10.5 to 10.8. Within each functional group, there is more similarity in attitudes among foresters in these groups across the different States, than there are differences. Regardless of whether foresters are in a 'clearcutting' or 'non-clearcutting' State, their attitudes reflect the general orientation of other foresters engaged in similar occupational activities.

Anderson et al (1982) provide another example of this effect. They found that faculty differences were much more significant than university differences in attitudes of students. The attitudes of students of a particular faculty, such as medicine, were more likely to be similar to the attitudes of medical students at another university, than to students in another faculty of the same university. Their attitudes reflect their particular social environment, and show that similar attitudes emerge in similar social environments, even though separated by large geographic distances.

If we go back to the biological analogy described previously, we would find that convergence in adaptations of biological organisms occurs when there is similarity in the environmental conditions of different species, and divergence when there is dissimilarity. For example, the prairie dog and rabbit have similar environments and also show similar biological adaptations for living underground. On the other hand, rabbits in the Arctic and grasslands have different biological and behavioural adaptations. There are many such examples.

We should be able to predict attitudes towards various social issues of groups at different positions along a social gradient, given some knowledge of the nature of the social gradient, the involvement of relevant groups in salient activities, the importance of the issue to the group's goals, and the inter-relationship between the group's activities and the issue to be studied.

Suppose we wish to examine attitudes towards the taxing of capital gains (ie non-income), we might choose to locate persons along a social gradient of wealth, and place them into approximate socio-economic classes. We might then examine their involvement in such activities as purchasing capital growth bonds, real estate, or other activities designed to produce capital gains.

As the importance of such activities increases among the groups, we would expect greater support for those activities, and also attitudes towards other activities consistent with the importance of purchasing activities. Thus, we might predict that attitudes among social groups towards taxing capital gains might vary from favourable among those for whom purchasing of capital growth bonds is unimportant, to unfavourable among those for whom capital growth bond buying is an important activity.

The integrated theory presented here suggests potential variables that can be identified to examine attitude variation between social groups in a social and ecological context. There are many similar applications to the above that could extend our knowledge of attitude acquisition, and the relationships between attitudes and social group members' activities.

These concepts express the view presented previously that attitudes can be considered a social survival mechanism. Attitudes appear to allow social adaptations within the social environment. Attitude variations within social hierarchies of the forestry profession show all the characteristics of variation in response to environmental conditions. That these variations were systematic along the social gradients described, adds further weight to the argument that attitude adaptation occurs within the social environment in response to variations in social conditions. Thus, the model described in this chapter provides a possible explanation for the variation in attitudes within the occupational structure of the forestry profession, and also provides a greater understanding of the attitude formation process within groups, and the role of attitudes in human existence and survival.

Attitude adaptations are not, however, necessarily guarantees of long term survival. Such adaptations within a social environment represent current responses to environmental conditions. As Burch (1971) suggests, social adaptations such as myths, rituals or organizational patterns may actually lead to long term maladaptivity.

Also, attitudes that are adaptive for a particular social group may not be adaptive for a larger social group, and act as a dynamic means of maintaining the social unity of a group.

SUMMARY

The propositions put forward in this chapter are built up from a social and ecological viewpoint, and are seen to provide a basis for a theory explaining attitude variation in the forestry profession. It is shown in Chapters 6 to 10 that differences between attitudes among foresters could be related to a number of factors, and that any of these factors could be used to interpret these differences.

It is shown that attitudes adjust to direct experience (Chapter 8) and to the social environment in a broad context (Chapters 6 and 7). Each of these adjustments could be regarded as attitude adaptations. In both cases a social gradient of differences in 'interactions' between the foresters' groups and an environment exists. In Chapter 8 this gradient is represented by social and direct activity interactions in a field operations context, and in Chapter 6 by interactions through participation in the social environment of a 'clearcutting' State. Attitudes adapted along these gradients are suggested here to be those most appropriate to the social conditions encountered by foresters in the situation of each group, for the time being. Attitudes that are most adapted could change to preserve their social survival value.

This theory and associated research findings can now be applied to an important aspect of attitude differences and adaptations; the potential impacts of these attitudes within an organizational context, and the effects these may have on the organization's interactions with a resource environment.

CHAPTER 13

APPLICATION

A social and ecological theory is developed to explain attitude variation among foresters. Figure 3.3 suggests attitudes should be examined in the context of a wider social and ecological framework. This framework is elaborated and an attitude adaptation model suggested (Figure 12.1). This describes the relationship between a social organization and its interactions with elements of the environment as a 'social gradient' or social environmental gradient. An attitude gradient will occur in response to this social gradient. The attitudes at points along the social gradient are suggested as those most appropriate or adaptive to the position of a social group along the social gradient. These relationships are described in Figures 12.1 and 12.5.

As we are dealing with organizations having the potential to generate important changes in physical, biological and social environments associated with forestry, the significance of the findings must be placed in an appropriate context.

Attitudes by themselves have no significance in what organizations may do. However, the combination of particular attitudes and persons with influence on policy formulation, strategic decision-making, or operational implementation of decisions in the field is of the utmost importance to the way the organization uses the resources at its disposal, or minimises the effects of such use. Thus, we will address this topic by first examining the concept of 'organizational adaptability'.

ORGANIZATIONAL ADAPTABILITY

Organizational adaptability in the context used here relates to the impact of the 'interaction' of the organization with the various parts of a resource environment. The less the impact, the more the organization is environmentally adapted to restrict the impacts of its activities. We will first examine some environmentally maladaptive organizational activities to emphasise the meaning of organizational adaptability.

The consequences of undesirable modifications to the environment have become increasingly apparent, and particularly since the global environmental awareness of the 1970's (Toffler, 1970; Commoner, 1977) brought many such problems into the public forum. These undesirable modifications are suggested here as maladaptive organization-environment interactions. For example, the problems associated with PCB (polychlorinated biphenyls) and DDT illustrate a significant maladaptive organization-environment interaction of serious proportions. That organizations design and build industrial plants that they know are ecologically harmful (Commoner, 1977) is another maladaptive interaction.

An unfortunate aspect of such maladaptive interaction is that the harmful effects on the environment may be ignored. Wolfe (1981) describes some of these effects when government ignores the environmental problems of industry.

There are many examples of this including: 'acid rain' and the 'greenhouse' effect. The long time lag between knowledge of harmful effects and government legislation to counter these effects is another case in point.

Ignoring existing environmental problems can lead to further unanticipated environmental problems; for example, the link now suggested between 'acid rain' and an increase in aluminium in water supplies of the U.S.A. and northern Europe. Pearce (1985) documents some of the problems now associated with an increase in aluminium in water supplies, which further emphasises the potential maladaptivity of decision-makers.

There are many examples of maladaptive organization-environment interactions, which appear to result from a lack of concern, or attitudes suggesting a lack of concern by management or policy makers, for the full consequences of such interactions. Commoner (1977) provides many examples of situations in which dangerous environmental pollutants were not controlled by industry, or inadequate protection to workers was provided. Asbestos is one material that was relegated to the 'harmless' category until there was too much evidence to be ignored. Similarly, the Monsanto company manufacturing PCB in the United States, only withdrew the chemical from sale 37 years after its toxic effects were known (Commoner, 1977).

In looking at organizational adaptability to the environment, we will focus here on attitude adaptations within the structure of an organization.

ATTITUDES AND ORGANIZATIONAL ADAPTABILITY

There are so many instances of resource based organizations creating and ignoring undesirable modifications to the environment, that it seems likely attitudes are an important determinant of organizational activities (Wildavsky and Tenenbaum, 1981).

One important role of resource based organizations should be environmental protection. As indicated in the examples given above, such protection was missing from the organizations' activities. The environmental adaptability of a resource based organization depends on the attitudes of senior managers and policy makers, and the decision implementers, to effective environmental protection. The Committee of Enquiry (1978) recognised the importance of this in the forest industry ... "it is essential that forest management personnel at the planning level have a thorough appreciation of all the relevant factors pertaining to environmental protection".

Some commentators during the early years of the Eden operation suggested that such appreciation did not exist (Routley and Routley, 1975). The attitudes of managerial and production foresters towards their organization's activities and how these might affect the environment are crucial to the adaptability of such organizations to their resource environment.

This section focuses further on the relationships between a social organization, a technology and a resource environment, by examining how attitudes within a social hierarchy reflect the potential adaptability of the organization.

The attitudes of managerial and production personnel towards a technology applied to a resource environment (such as clearcutting applied to eucalypt forests) determine in part the types of technologies considered by the organization. The type of 'technology' affects the nature of environmental effects. Thus, attitudes affect organizational adaptability through the decisions based on these attitudes to the use of a specified technology, and the effects of such technology implemented by the organization. The organization is wholly responsible for the final decision it makes and must take responsibility for the impacts these decisions have on the environment.

Figure 13.1 shows these suggested relationships in terms of a social ecology framework.

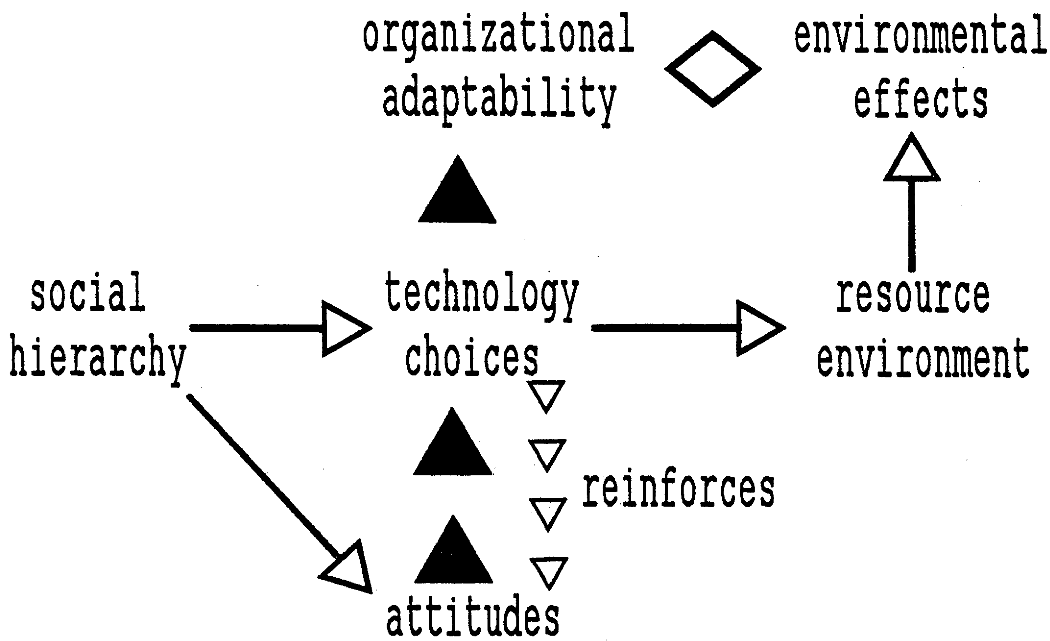

FIGURE 13.1

ATTITUDES AND ORGANIZATIONAL ADAPTABILITY

Having now examined some concepts related to organizational adaptability and the role of attitudes in this respect, we will focus on how the attitudes of Australian foresters might affect the adaptability of the various forestry organizations in Australia.

FORESTRY ORGANIZATIONS AND THEIR POTENTIAL ADAPTABILITY

Analyses in Chapter 10 show that foresters in positions of most influence in organizational decision-making are also those most supportive of clearcutting. As suggested by Figure 13.1, decisions made about technologies would tend to reinforce those decisions and the continuation of the same technologies, unless change is imperative. As attitudes support the activities of the organization most amongst the 'managerial' and 'production' foresters, there would be some reluctance on their part to consider major changes to those activities.

Attitudes adapted to the social conditions within the management and production levels of the forestry profession are directed towards the organization. The relationship between attitude adaptations and adaptability to the resource environment is shown in Figure 13.2 for the 'power' hierarchy, and Figure 13.3 for the 'environmentalism' hierarchy. As attitudes become more adapted to the organization among the top decision-makers, the organization's adaptability

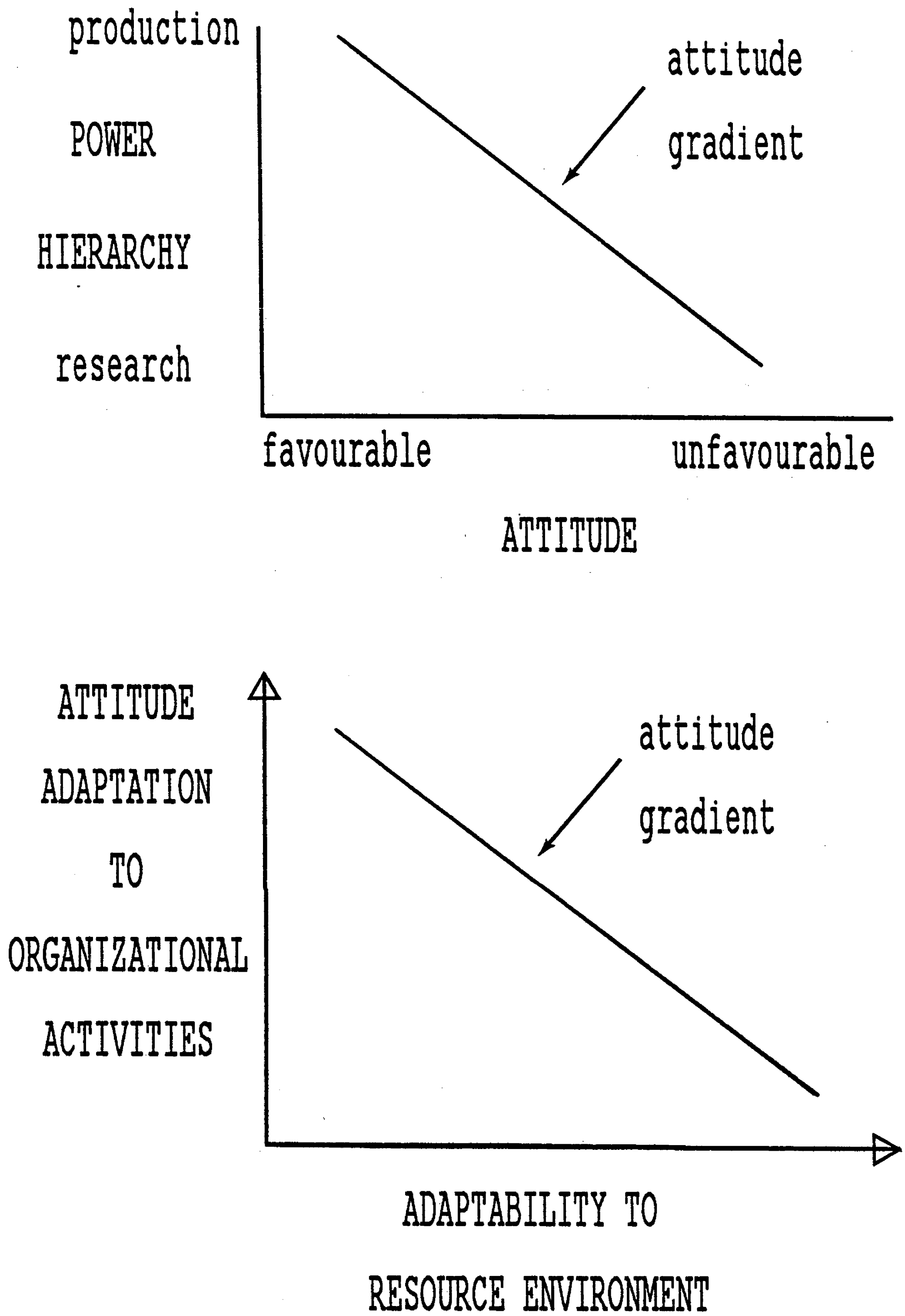

FIGURE 13.2

ATTITUDES, "POWER" AND ADAPTATION

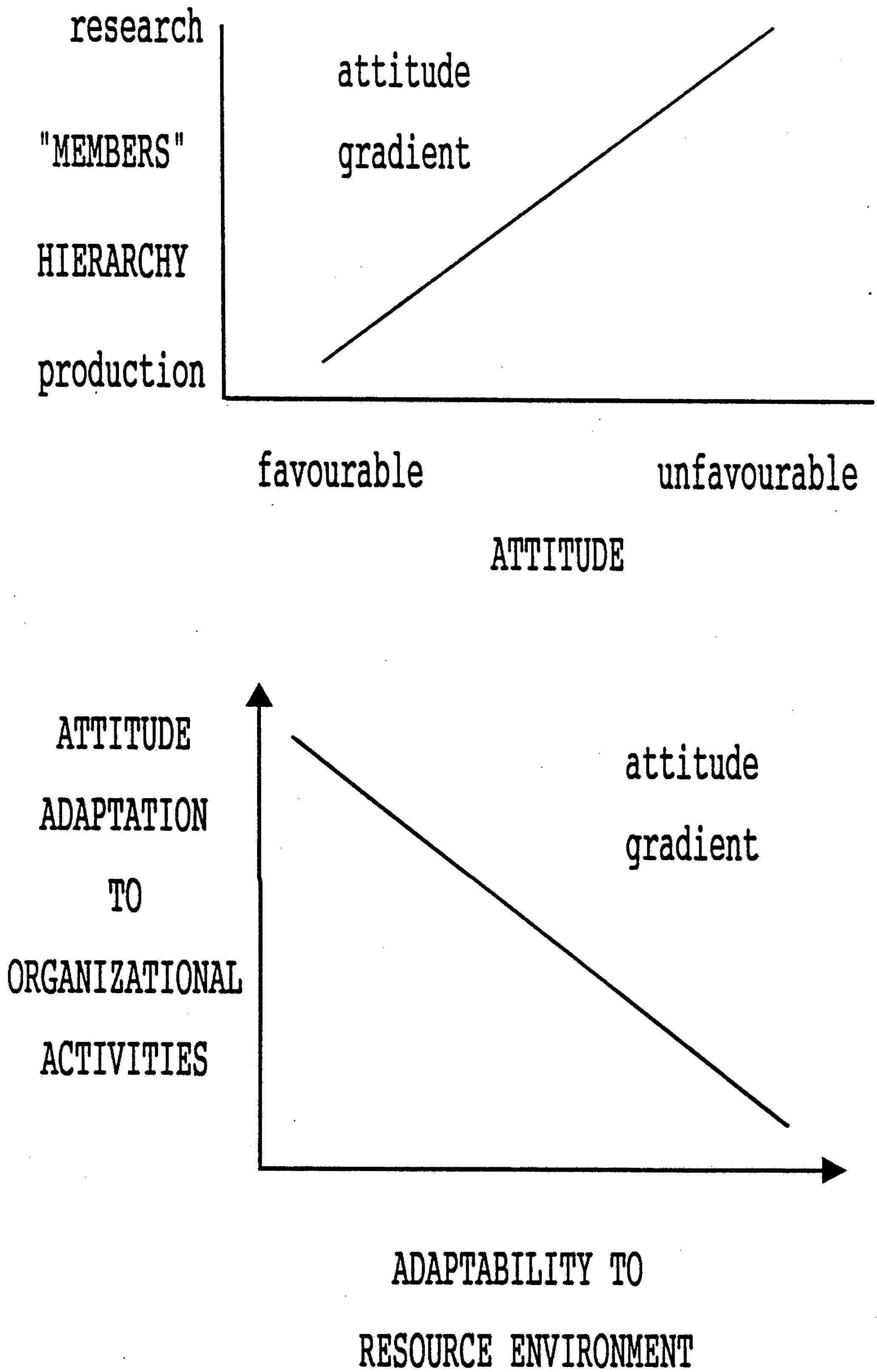

FIGURE 13.3

ATTITUDES, "ENVIRONMENTALISM" AND ADAPTATION to the outside environment will decrease. This does not imply that the organization is not adapted to meeting its own aims or objectives.

Two types of attitude adaptations are evident among 'managerial' and 'production' foresters. The first is that attitudes of 'managerial' and 'production' foresters act to legitimize the activities of forestry organizations. This is seen in the strength of their denial that environmental effects are probable during clearcutting operations. As noted in Table 10.6, 'managerial' foresters in the various States of Australia show few differences, suggesting support for forestry activities across Australia is not confined to the States carrying out those activities. This suggests also that there would be little conflict on the issue of clearcutting among the top decision-makers of the various forestry organizations. Thus, foresters in these positions would tend to support the validity of decisions made by other forestry organizations.

The second adaptation represents a rationalization of organizational activities. This is illustrated by the 'managerial' and 'production' foresters' responses to the seriousness of environmental effects. As Figure 9.3 illustrates, these responses show a disagreement that effects are serious. The combination of a denial of effects and disagreement that any effects are serious suggests a strong rationalization for clearcutting operations. This rationalization was further emphasised by beliefs that environmental protection is adequate. Of course there may be other rationalizations for an organization's activities, suchj as economics, local employment, and making a profit.

The apparent orientation of forestry organizations towards clearcutting activities is of concern to environmental groups in Australia. There is a common belief among conservation groups in Australia that forest industry organizations and some political forces are not concerned enough about the impacts of clearcutting on eucalypt forests (Bartholomaeus, 1983).

The adaptability of forestry organizations is in the hands of the decision-makers. If the adaptability of these organizations is to become more environmentally and ecologically oriented, the attitudes of managerial and production foresters will need to be changed. There appears to be scope for input of less organizationally oriented attitudes into decision-making if research and administrative foresters are given more access to decision-making processes, or wide consultation with such foresters in the various organizations is carried out.

The apparent adaptability of forestry organizations among the different forestry operations in Australia also differs. The power of large timber and pulp and paper companies has had significant effects on harvesting operations in some states; for instance, Howitt (1982) suggested large pulp and paper companies were able to 'persuade pliant governments to grant them

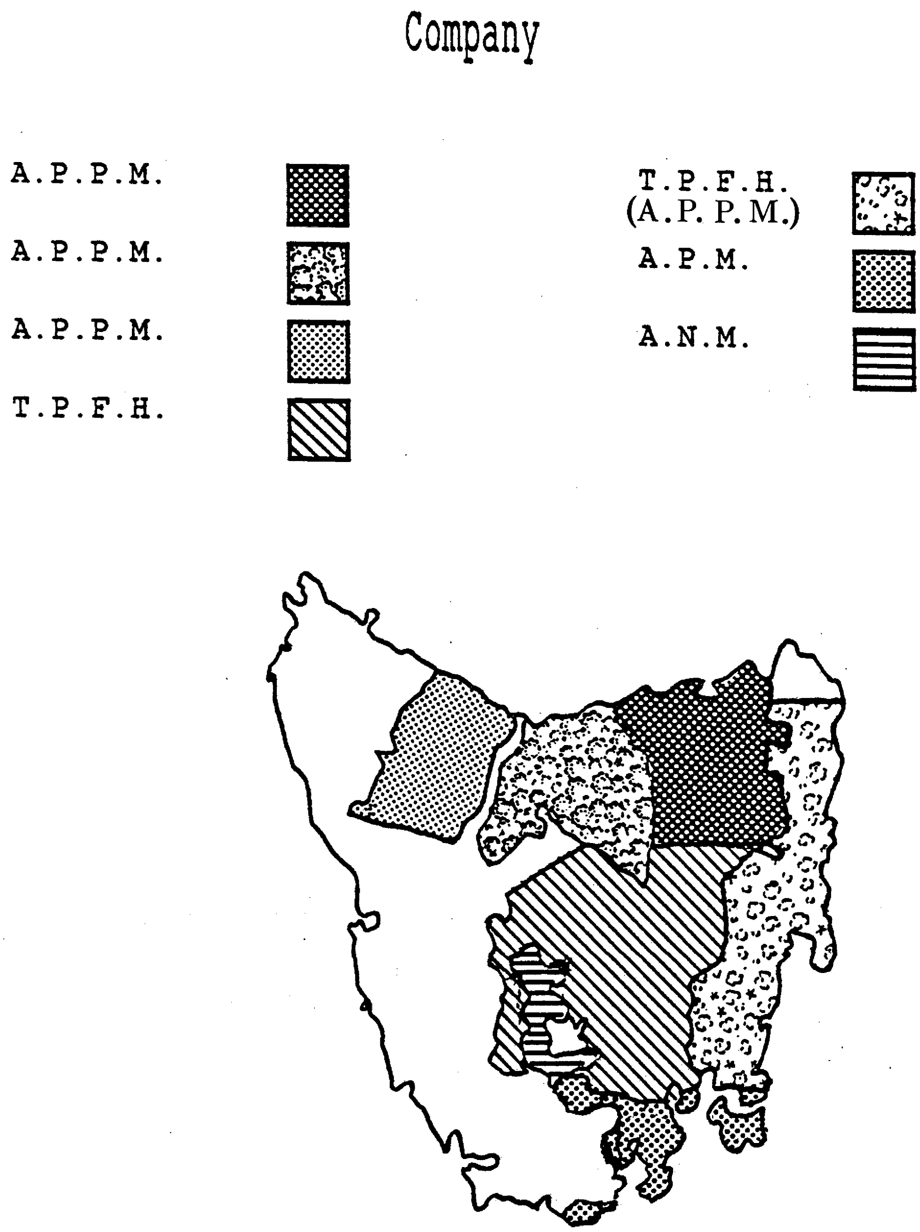

FIGURE 13.4

TIMBER CONCESSION AREAS TASMANIA

After Howitt (1982)

concession areas with exclusive timber rights over vast tracts of State forests' in Tasmania. The extent of some of these concessions is shown in Figure 13.4. This suggests 'power' and 'influence' of monopolistic proportions. Howitt (1982) also suggests that the Tasmanian forest industry pays too little attention to the impacts of clearcutting and takes inadequate protection measures. Such lack of attention could be interpreted by some as a greater concern for meeting forest company log demands than maintaining the forest in an environmentally and ecologically sound condition.

Subsidised harvesting with low royalty rates (Douglas and Byron, 1981; Howitt, 1982) could also be seen as focusing primarily on meeting the organizational objectives of forest industries, and inadequate consideration of the forest environment. When royalty rates are low, there is less incentive to reduce cutting rates to the sustainable yield of the forest. Rather, stockpiling would be worthwhile.

Disregarding prescribed regulations and not following proper protection procedures is another indication that the forest environment may be secondary to forestry organizations' activities. For instance, the Council to Save Native Forests suggested that logging contractors removed logs from a quarantine area against government regulations (C.S.N.F., 1983).

The legitimacy of organizational activities is readily found in statements of the various forestry organizations throughout Australia. These generally emphasise better utilization, socio-economic advantages and improved forest productivity, or responsibility to loggers and the local community.

GENERAL SUMMARY

The conditions for survival in the upper levels of an organization require the type of responses given by foresters at these levels. Attitudes strongly supporting the organization are thus survival mechanisms for the continuity of the organization. These attitudes are not necessarily suitable for sound environmental decisions and adaptive organizational interactions with the environment.

The issues addressed in this thesis suggest a need to examine who makes forest use policies and decisions. It suggests similar attitudinal problems could occur in other resource based organizations among senior decision-makers. The author holds the view that attitudes and values may have too great an effect on decision-makers, and that an environment oriented, social and ecological approach to the allocation and planning of resources is necessary.

Policy makers would tend to make decisions more adapted to maintaining the environment, if their attitudes towards resource use were less constrained by the need to meet organizational objectives and loyalty to organizational activities. Such dilemmas may be difficult to resolve, without some changes in the way policy makers perceive the environment. Some changes are also needed in the political decision-making process, so that important resource decisions are based more on sound ecological principles, and less on ideology. The possibility of environmentally oriented resource decisions is not, however, likely to be improved by better data, as Wildavsky & Tenenbaum (1981) noted. A basic problem lies at the junction between individuals' attitudes and values, their environment, economics and politics.

CHAPTER 14

CONCLUSION

In this chapter the major research findings are documented. These findings are examined in terms of their implications for Australian forestry and for social ecology as a basis for studying human responses to the environment.

RESEARCH FINDINGS

I A foresters' 'territory' or physical location in a 'clearcutting' or 'non-clearcutting' State engenders attitudes consistent with the forestry practices of that 'territory'. Thus, foresters who reside in the 'clearcutting' States are more favourable towards 'clearcutting' than are foresters in the 'non-clearcutting' States. A 'group attitude' is apparent among foresters in the 'clearcutting' States.

II Foresters who are members of both the Institute of Foresters and any of the conservation organizations in Australia are less supportive of clearcutting practices, than are foresters who belong only to the Institute. This effect is apparent among foresters from both 'clearcutting' and 'non-clearcutting' States, and illustrates that interactions with other social groups can have effects on attitudes.

Attitudes could also be responsible for foresters joining such organizations in the first place. Further research would be needed to determine how the attitudes of members of conservation organizations change with increasing membership experience. This would allow empirical testing of the proposition of this thesis that attitudes become more adapted to the social environment with increasing experience in that environment. The attitudes of new members would also be useful for such an exercise.

III Field and management experience of clearcutting is associated with more favourable attitudes towards clearcutting. This effect occurs among foresters in both 'clearcutting' and 'non-clearcutting' States, and illustrates attitude-activity consistency directly.

Management experience is shown to have a greater effect on attitudes than field experience, but the overall effect depends on whether foresters have one or both types of experience.

IV The effects of 'territory', membership of conservation organizations, and direct experience are summarised as a group. Management experience and 'territory' are the most important determinants of foresters' attitudes among those factors, accounting for similar variance in attitude scores.

V The attitudes of foresters vary depending on the type of forestry activities in which they engage. Foresters in research and administration are less favourable towards clearcutting than are foresters in managerial or production related positions.

Several reasons for this variation are suggested. Differences in State of residence can partly account for the more supportive attitudes of 'managerial' and 'production' foresters, as can the difference in management experience among foresters. There is a gradation from most favourable among 'production' foresters, to least favourable among administration foresters. This suggested that involvement in organizational decision-making might be related to the attitude gradation.

VI The hypothesis that organizational involvement in decision-making helps to determine attitude was tested. Using concepts of organizational division of functions, a ranking of the four groups in terms of formal access to policy formulation and decision-making was then related to attitudes. The groups with most access to such decision-making are the 'production' and 'managerial' foresters who also have the most favourable attitudes towards clearcutting. When the groups are ranked on the basis of membership of conservation organizations, the ranking is the reverse of access to decision-making, and attitudes vary in the opposite direction.

These analyses suggest that consistency in attitudes among foresters should occur within a particular level of a social hierarchy, such as access to decision-making, across other social boundaries. It is shown that the attitudes of foresters within the 'occupational' groups are consistent across the States of Australia.

VII An examination of the attitudes of forest workers' towards clearcutting, and a qualitative comparison with those of foresters closest to management and harvesting functions, shows there is much similarity in attitudes between foresters in those positions and forest workers, on most issues.

VIII The thesis concludes with a theoretical synthesis and develops an integrated theory to explain the observed gradations in attitudes; i.e. that attitudes are social survival mechanisms adapted to the social environment in which one is located. Such an approach allows examination of other social groups in relation to each other and in their interactions with the environments in which they exist.

This theory is then applied to the effects of attitude adaptations within organisations and the forestry situations, and some further concepts elaborated. The variation in attitudes evident among Australian foresters suggests a need for greater consultation among foresters.

This research did not and could not, address the possibility that managerial foresters held attitudes supportive of their organization's activities before entering managerial positions. Such a possibility suggests further research requiring a longitudinal study of a social group such as foresters, beginning with newly graduated foresters.

The propositions presented in this thesis could be tested by exploring a number of research avenues. These include:

(1) A study of recently graduated foresters who have not taken up duty in either a 'clearcutting' or 'non-clearcutting' State, involving initial testing of attitudes and retesting over a number or periods;

(2) identifying foresters who have left either a 'clearcutting' or 'non-clearcutting' State and moved to the other, testing their attitudes after such a move and retesting at later periods to determine how their attitudes have changed after exposure to the new social environment;

(3) identifying foresters who have left managerial or production areas, determining the reasons they have done so, and comparing the attitudes of those who left with those who remained;

(4) tracing the changing activities of foresters, and testing their attitudes through each of those activities.

Attitudes most useful to test would be those towards activities important to the social group into which a forester is moving, or from which a forester has moved.

Such studies would assist in understanding the processes underlying human responses and how these change in the social milieu.

The relationships and attitudes emerging from this study are summarised in Figure 14.1. Here it is shown that attitudes become more favourable towards clearcutting when involvement is direct, or when professional activities are in organizationally oriented positions. The paths through the social dimensions are indicated by arrows in the figure, which point to the attitudes arising.

IMPLICATIONS FOR SOCIAL ECOLOGY AND HUMAN RESPONSES

The ecological approach taken to the study of foresters' attitudes in this thesis illustrates several important social and evnvironmental factors. Placing forestry in the context of a social organization, which interacts with the forest, indicated where we might find variation in foresters' responses to their professional activities. Such an approach enabled the study of social factors beyond attitude-activity consistency, and

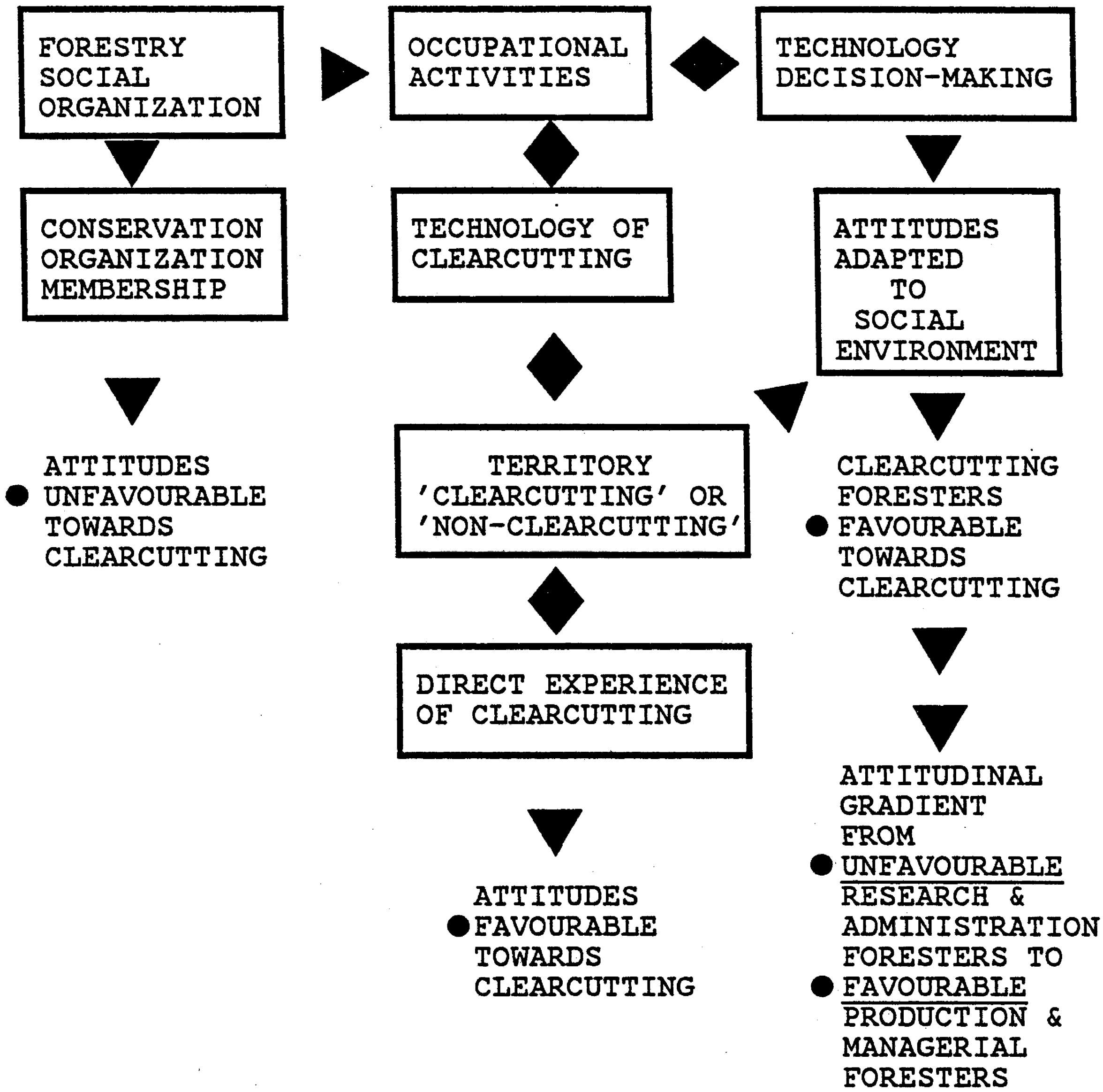

FIGURE 14.1

THE RELATIONSHIPS BETWEEN FORESTERS' SOCIAL EXPERIENCE AND ATTITUDES way to various issues, or are affected in the same way by others' activities.

This research extends our knowledge of the factors underlying human social responses, attitudes, and suggests that social and environmental pressures can influence human responses, making social responses atuned to one's social environment in very specific ways.

IMPLICATIONS FOR FORESTRY

The attitudes of forest rangers in the U.S. Forest Service severely limited their capacity to view alternative land management options objectively (Twight, 1983). Similarly, water supply managers limited their decision-making horizons by their attitudes towards water conservation (Sawyer, 1982).

Janis (1982) documents many instances where decision makers were affected by subjective beliefs, which tended to inhibit rational and objective decisions in many cases.

Ajzen (1982) provides evidence that an individual's behaviour in relation to specific activities is highly correlated with their beliefs and attitudes towards those issues. This occurs even though attitudes do not necessarily correlate well with an individual's more general activities. This is significant in the forestry context of this thesis. While foresters may generally believe in the importance of environmental protection and conservation, on specific issues such as the impact of clearcutting, some foresters do not reflect the general environmental orientation of other foresters. These foresters are more likely to accept clearcutting activities and to be less critical of such activities than other foresters. In these considerations, it is important that foresters in decision-making roles accept that they are affected by the subjective effects of attitudes.

The reluctance of foresters to accept that the impacts of their activities are seen as undesirable by some groups in society has contributed to some loss of control over decision-making in relation to forestry practices. Two States have now integrated forestry activities into a more general land management department, taking away the exclusive managerial preserve foresters previously held.

Differences in attitudes and beliefs between foresters and society has led to social conflict about clearcutting operations. Such conflict however, can be constructive, and provide an avenue for improving decision-making within forestry organizations. Social conflict can stimulate research, discussion and improved operational standards.

The differences in attitude noted in this thesis are sufficient to suggest that wider consultation among foresters could lead to more acceptable environmentally and ecologically sound decisions.

There is increasing awareness of the need to consult and involve all parties in social conflict, especially in natural resource use decisions (Lee and Burch, 1986). Foresters need to see their activities as part of the social system, if forestry organizations are to adapt to changing social expectations.

Greig (1986) suggests that forestry is now a social and political matter. Foresters should thus to consider issues in the context of the social and political world, as well as by the principles of sound silvicultural practice. Foresters provide a service to society by managing an important natural resource capable of sustained production. Management of forests and the role of foresters as forest managers might drastically change in the future, unless foresters are able to convince society that they are not just producers of timber (Carron, 1986).

However, methods being implemented in various U.S. based land resource organizations show that managers are beginning to appreciate their role as social and biophysical managers (Lee and Burch, 1986). It is hoped that Australian foresters will follow this lead.

THE AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF FORESTRY

HEAD OF DEPARTMENT
PROFESSOR D. M. GRIFFIN
M.A., Ph.D., Sc.D. (Cantab.)

P.O. BOX 4
CANBERRA, A.C.T. 2600
TELEPHONE 49 2579

Dear Forester,

Enclosed with this letter is a questionnaire, which is being forwarded to all members of the Institute of Foresters of Australia. This questionnaire is related to issues brought up in articles and public enquiries about adverse environmental effects of clearcutting of native forests. This questionnaire aims to identify what professional foresters believe about these issues, and to examine some general conservation and environmental protection beliefs of the professional body of foresters within the Institute.

This questionnaire is part of a research project being undertaken for a PhD in the Department of Forestry, A.N.U. and is an attempt to examine human aspects of forestry, and to merge the disciplines of Forestry, Psychology and Forest Sociology. This initial questionnaire is being restricted to the professional forester; it is planned to extend the survey to others in the forest products industry. No conservation groups are being included in the study. It is therefore important that as large a sample as possible of forester's beliefs is obtained, to allow a more rigorous analysis of responses.

It is important that all items in the questionnaire be answered even though some may appear similar. Thankyou for your assistance.

Yours sincerely,

Kathryn Hawkins

THE AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF FORESTRY

EAD OF DEPARTMENT
ROFESSOR D. M. GRIFFIN
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P.O. BOX 4
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TELEPHONE 49 2579

date

CLEARCUTTING AND NATIVE FORESTS

This questionnaire seeks your personal opinions and beliefs about a number of issues related to clearcutting of native forests. Clearcutting will be restricted to those operations within the eucalypt forests where all or most of the forest growing stock is cut to supply sawlog or pulpwood or both, on continuous rotations, and where the forest will be managed subsequently for continuing production of wood, largely of those species occurring naturally on the site. It is not concerned with clearcutting of Pinus or other species, or with clearcutting preliminary to replanting with softwood species.

Many of the issues may apply to any form of clearcutting, but for the purpose of this questionnaire, only native forest clearcutting is involved. The issues included in this questionnaire are derived from a review of a large number of articles, submissions to public enquiries, government committees and the like, in relation to the woodchip industry and clearcutting practices. For all items presented you are asked to make a subjective evaluation, and to indicate your response by selecting a category that comes CLOSEST to your personal view. It is appreciated that different responses could be made depending on site and operator differences. For the purposes of this questionnaire, consider the issues in relation to average forest sites with typical operation standards.

Responses to this questionnaire will be used in a study of perceptions and beliefs of professional foresters about clearcutting effects. It is the initial part of a research project for a PhD in the Department of Forestry, A.N.U. All responses to the questionnaire will be anonymous and confidential. This research project is partly supported by a research scholarship under the Alan R. Henderson Bequest administered by the I.F.A.

There are five sections to the questionnaire, each contains instructions for answers. Please complete all items in each section. The first section deals with your experience in forestry. The next section presents some general comments about conservation and clearcutting. The third and fourth sections deal with postulated adverse environmental effects from clearcutting, and the fifth with environmental protection and reducing adverse effects.

Thankyou for your assistance.

Kathryn Hawkins
Department of Forestry,
A.N.U. 062 492361

The following questions deal with your professional experience as a forester and will be used for statistical comparisons. For these questions please tick the appropriate answer.

HAVE YOU HAD ANY FIELD EXPERIENCE WITH CLEARCUTTING OPERATIONS IN NATIVE EUCALYPT FORESTS?

Yes .... No ....

1 2

WHAT WOULD BEST DESCRIBE THE TYPE OF FORESTRY YOU ARE MOST INVOLVED IN AT PRESENT?

1. Field operations and supervision ...
2. Writing management plans ...
3. Design of cutting plans ...
4. Management planning ...
5. Research ...
6. Forest landscaping plans ...
7. Forest engineering plans ...
8. Policy development ...
9. Training of forest gangs ...
10. Administration of office personnel ...
11. Forest inventory ...

other (please specify)..

HOW MANY YEARS HAVE YOU BEEN INVOLVED IN DIRECT MANAGEMENT OR PLANNING OF CLEARCUTTING OPERATIONS IN NATIVE FORESTS?

1. none ....
2. 1 to 5 years ....
3. 6 to 10 years ....
4. more than 10 years ....

HOW MANY YEARS HAVE YOU BEEN INVOLVED IN ANY FORM OF FORESTRY?

1. 1 to 5 years .... 2. 6 to 10 years ....

3. 11 to 20 years .... 4. more than 20 years ....

DO YOU BELONG TO ANY CONSERVATION OR ENVIRONMENTAL ORGANISATION, SUCH AS THE NATIVE FORESTS ACTION COUNCIL OR THE AUSTRALIAN CONSERVATION FOUNDATION?

Yes ..... No .....

1 2

****

THE FOLLOWING STATEMENTS ARE SOME GENERAL COMMENTS ABOUT CONSERVATION, CLEARCUTTING AND SOCIETY, WHICH COULD APPLY TO ANY NATIVE FOREST. PLEASE INDICATE HOW MUCH YOU AGREE WITH EACH STATEMENT BY CIRCLING THE NUMBER NEXT TO THE CATEGORY CLOSEST TO YOUR LEVEL OF AGREEMENT, e.g. 2. not much.

1. **To ensure the availability of resources into the future, society needs to place greater emphasis now on the use of renewable resources such as from forests, instead of replacement products such as plastics, concrete or steel.**

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain

2. **Not enough is known about the long term effects of clearcutting native forests, to discount the possibility that undesirable environmental changes could occur.**

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain

3. **Clearcutting followed by a hot slash fire is similar in its effects to those of wildfires, which historically burnt the eucalypt forests.**

1. none	2. not much
3. somewhat	4. high
5. very high	6. uncertain

4. Better training and greater awareness of environmental problems by harvesting operators, could significantly improve environmental protection in native forest clearcutting operations.

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain

5. Detailed preplanning is needed for the requirements of wildlife, recreation, landscape management and hydrology before cutting operations commence.

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain

6. Costs of protecting the forest during harvesting operations should be proportioned in equal amounts between the consumer of wood products, the forest industry being supplied and the forest owner.

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain

7. Permanent reserves of uncut forest are too few, and these are too small for possible requirements of future users and non-wood related activities.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

8. More native forest wildlife reserves are needed through forests with a clearcutting regime, either as separate reserves or as corridors between uncut and cut forest.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

9. More easily enforceable and effective legal means are needed to deal with breaches of environmental protection standards.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

10. There should be a reassessment of the level of wood commitments to the sawlogging and pulpwood industries in order to meet reasonable conservation objectives.

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain

11. Protecting the natural environment, and in particular forests, is fundamental to the long term survival of society.

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain

12. Continued economic growth could eventually lead to depletion of natural resources below replacement abilities of the natural environment.

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain

13. **Environmental problems in the native forest harvesting industry are less severe than similar problems associated with other activities, such as clearing for agriculture.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

14. **More native forest area needs to be put into permanent reserves which are representative of the forest types involved in clearcutting operations in your State.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

15. **The forest owner should contract directly with harvesting contractors and operators in native forests, to improve the possibility of ensuring maximum protection to the forest environment.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain

16. The industry sector should be expected to contribute more to the costs of environmental protection.:

1. not at all 2. not much
3. somewhat 4. a lot
5. totally 6. uncertain

17. State Forestry Acts need to be more explicit than at present in details of requirements for protecting non-wood values and fauna.

1. not at all 2. not much
3. somewhat 4. a lot
5. totally 6. uncertain

18. What priorities would you place on the following, in selection of coupe size, location and design, given an average forest situation. Indicate an order with numbers.

a. production needs .... b. wildlife needs ....
c. recreation needs .... d. hydrology requirements ....
e. landscape maintenance .... f. fire protection ....

****

The following set of items deal with postulated adverse environmental effects from the clearcutting of native forests, which have been brought up in public enquiries and articles. There may be no right answers to the statements, and the questions posed are NOT A TEST OF KNOWLEDGE, but are seeking PERSONAL beliefs about these issues. For all items presented, indicate which category you choose by circling the number corresponding to that category, for example 1. not at all.

HOW PROBABLE DO YOU THINK EACH OF THE FOLLOWING POSTULATED ADVERSE EFFECTS IS FOR NATIVE FORESTS UNDER CLEARCUTTING PROGRAMMES?

1. **A reduction in the diversity of forest settings for such activities as bushwalking, picnicing, nature study and birdwatching will occur in the forest for some time after cutting.**

1. not at all	2. not much
3. somewhat	4. highly
5. very highly	6. uncertain
7. insufficient information available	

2. **Any appeal and attractiveness of the native forest landscape in forests with a clearcutting programme will be reduced:**

from a distant or panoramic view

1. not at all	2. not much
3. somewhat	4. highly
5. very highly	6. uncertain
7. insufficient information available	

from within the forest

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

3. Populations of native animals, such as possums and gliders, which require a forest canopy will be adversely affected in the long term (after at least one rotation) in forests with clearcutting programmes.

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

4. A reduction in overall native animal species diversity will inevitably occur within clearcut units of forest for some time after cutting.

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

5. Canopy dwelling and hollow nesting birds may be adversely affected in the long term by the loss of habitat in forests with clearcutting programmes.

1. not at all
2. not much
3. somewhat
4. high
5. very high
6. uncertain
7. insufficient information available

6. Many native animal species will be significantly reduced in numbers within clearcut units for some time after cutting.

1. not at all
2. not much
3. somewhat
4. highly
5. very highly
6. uncertain
7. insufficient information available

7. Overall plant species diversity in regenerated forests cut on continuous rotations will be less in the long term, (after 3 to 4 rotations) than in uncut forest.

1. not at all
2. not much
3. somewhat
4. highly
5. very highly
6. uncertain
7. insufficient information available

8. Changes to plant species composition and site productivity resulting from clearcutting will lead to an increasing susceptibility of the forest to disease.

1. not at all   2. not much
3. somewhat   4. highly
5. very highly   6. uncertain
7. insufficient information available

9. Long term changes will occur to the plant species composition of any clearcut forest.

1. not at all   2. not much
3. somewhat   4. highly
5. very highly   6. uncertain
7. insufficient information available

10. There will be an increase in the likelihood of flooding of forest streams that flow through clearcut logging areas.

1. not at all   2. not much
3. somewhat   4. highly
5. very highly   6. uncertain
7. insufficient information available

11. The concentration of dissolved salts and suspended matter will rise in streams through forests with clearcutting programmes, particularly where less stable soils occur.

1. not at all
2. not much
3. somewhat
4. highly
5. very highly
6. uncertain
7. insufficient information available

12. Some soil erosion will occur from within clearcut units of forest on <u>stable</u> soils.

1. not at all
2. not much
3. somewhat
4. highly
5. very highly
6. uncertain
7. insufficient information available

13. Soil erosion will inevitably occur from within cleared units of forest on <u>unstable</u> soils.

1. not at all
2. not much
3. somewhat
4. highly
5. very highly
6. uncertain
7. insufficient information available

14. Continuous clearcutting rotations will lead to a loss of nutrients and a reduction in long term site productivity on forest soils of average site quality.

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

15. There is a potential danger that outbreaks of pests and disease will occur in and around clearcut forest units until vigorous regrowth is established.

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

16. The natural replacement of nutrients over a sawlog rotation will not compensate for nutrient losses associated with hot slash burning.

1. not at all 2. not much
3. somewhat 4. highly
5. very highly 6. uncertain
7. insufficient information available

****

THE FOLLOWING ITEMS REQUIRE A SIMILAR TYPE OF RESPONSE TO THOSE PREVIOUSLY. FOR THIS SET OF ITEMS, INDICATE HOW SERIOUS YOU CONSIDER EACH OF THE POSTULATED EFFECTS IS FROM CLEARCUTTING NATIVE FORESTS.

1. Soil nutrients are removed from average forest soils in the long term, particularly on less stable types.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

2. Soil movement and its redistribution within the cutting coupe.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

3. Increased likelihood of floods in streams through forests with clearcutting programmes.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

4. Sedimentation in forest streams through clearcut logging areas arising from logging and associated road construction and maintenance.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

5. Changes in the forest landscape for the first five years after cutting:

a. from a distant or panoramic view

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

b. from within the forest

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

6. Dangers of pest and disease outbreaks in clearcut forest areas before regeneration is established.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

7. A reduction in the diversity of plant and animal species in regenerated forests resulting from any clearcutting programme.

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

8. Long term changes in the plant species composition of forest clearcut on continuous rotations..

1. not at all serious 2. not very serious
3. somewhat serious 4. very serious
5. unacceptable 6. uncertain
7. insufficient information available

9. Long term changes in the ecological stability of the forest ecosystem in clearcut native forest, particularly the more complex forest types.

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

10. Native animal species diversity decreases in forest with clearcutting regimes:

a. In the short term

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

b. In the long term, particularly with continuous clearcut rotations.

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

11. **Long term reduction in native animal populations in forests with a clearcutting regime.**

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

12. **Long term reduction in crown and canopy habitats for native birds and animals in forests with clearcutting regimes.**

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

13. **Reduced opportunities for recreation activities such as bushwalking, picnics, birdwatching and nature study in forests with clearcutting regimes.**

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

14. Reduced site nutrient capital through the use of hot slash burning.

1. not at all serious
2. not very serious
3. somewhat serious
4. very serious
5. unacceptable
6. uncertain
7. insufficient information available

****

THE NEXT SET OF ITEMS REPRESENT POSSIBLE WAYS OF REDUCING ENVIRONMENTAL EFFECTS RESULTING FROM CLEARCUTTING. FOR THIS SET OF ITEMS, INDICATE HOW MUCH YOU AGREE WITH THE STATEMENTS IN THE SAME MANNER AS PREVIOUSLY.

1. **Coupes should be located so that there is always a range of forest settings close to each other for recreation and other non-wood activities during the clearcutting cycle in native forests.**

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain
7. insufficient information available

2. **Mechanical site disturbance should be used wherever possible for seed bed preparation, to minimise losses of nutrients from burning.**

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain
7. insufficient information available

3. **Established regeneration should be assessed and checked for pests and disease at least every six months for two to three years after regeneration is established.**

1. not at all   2. not much
3. somewhat   4. a lot
5. totally   6. uncertain
7. insufficient information available

4. Clearcut forest units should be examined periodically, at least every three months, for potential pest and disease problems prior to successful regeneration.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

5. Surveys of native animals are needed in each forest area to ensure adequate provision can be made to conserve these species according to their known requirements.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

6. Specific planning at the compartment level is required to ensure native animal needs are met in the size, location and design of coupes, and retention of corridors.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

7. More habitat trees should be left uncut in each clearcut unit of native forest.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

8. Coupes should be located in clearcut forests so as to reduce any visual impacts from panoramic viewing points.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

9. Clearcutting should not be carried out within the viewing limits of panoramic or vista forest landscapes, as seen from the major access routes.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

10 **Identification and mapping of sensitive forest landscapes is needed prior to drawing up cutting plans for any area of native forest, so that coupes can be located to maintain these landscapes as much as possible.**

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain
7. insufficient information available	

11. **Extra planting may be necessary for species disadvantaged in a newly regenerating native forest.**

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain
7. insufficient information available	

12. **Some form of selection logging should be used where appropriate, within forest normally subject to clearcutting regimes, to help maintain biological and aesthetic diversity, and a continuous sawlog supply.**

1. not at all	2. not much
3. somewhat	4. a lot
5. totally	6. uncertain
7. insufficient information available	

13. Detailed surveys to assess species composition and stocking rates of regenerating native forests following clearcutting are a necessary part of forest management.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

14. Although environmental controls provide for the protection of streams, still greater care is needed in the building of stream crossings and working near streams during clearcutting operations.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

15. Felling operations in all sensitive areas, such as into or near filter strips, should be specifically supervised during clearcutting operations in native forest.

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

16. **Regular and comprehensive water sampling in any type of forest stream through clearcut forest is necessary during operations.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

17. **There is need for greater regulation and supervision of heavy machinery working in clearcutting operations in native forests.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

18. **Monitoring of aquatic life in forest streams should be part of forest management in clearcut areas.**

1. not at all
2. not much
3. somewhat
4. a lot
5. totally
6. uncertain
7. insufficient information available

19. **There should be a gradation of filter strip widths to take differing soil and slope conditions into account.**

1. not at all 2. not much
3. somewhat 4. a lot
5. totally 6. uncertain
7. insufficient information available

20 **Clearcut coupes should be small, such as 1 - 2 hectares where wildlife, hydrology and landscape maintenance requirements suggest this is appropriate.**

1. not at all 2. not much
3. somewhat 4. a lot
5. totally 6. uncertain
7. insufficient information available

****

Please check that you have completed all items. **THANKYOU FOR YOUR CO-OPERATION.**

Any other comments?

APPENDIX A

FORESTERS' QUESTIONNAIRE

THE AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF FORESTRY

OF DEPARTMENT
FESSOR D. M. GRIFFIN
, Ph.D., Sc.D. (Cantab.)

P.O. BOX 4
CANBERRA, A.C.T. 2600
TELEPHONE 49 2579

CLEARCUTTING NATIVE EUCALYPT FORESTS

Date:

survey of industry beliefs.

This questionnaire will be given only to people employed in the arvesting of forests. Your views are important to this study, which is ooking at what the forestry industry thinks about clearcutting effects in ative Eucalypt forests. It is not a test of your knowledge about these ssues, but seeks your personal opinions. This study is being restricted to eople working in forestry, and responses to the questionnaire will be nonymous and confidential. Your co-operation and assistance in this study ould be appreciated.

KATHRYN HAWKINS

DEPARTMENT OF FORESTRY,

The following questions deal with your experience in forest work. For eac question please tick where appropriate.

How many years have you been working in native forests.

1. less than 1 year ....
2. 1 to 5 years ....
3. 6 to 10 years ....
4. more than 10 years ....

What type of work do you do?

1. dozer, tractor or skidder driver ....
2. faller ....
3. supervisor ....
4. dumpman ....
5. foreman ....
6. loader driver ....
7. truck driver ....

Would you change your job if there was other employment available?

Yes	....	No	....
1		2	

Do you work in a crew?

Yes	....	No	....
1		2	

If yes, how long have you worked with the same crew? ....

ne following questions deal with some general environmental issues related to ne forestry industry. For each question mark your answer by circling the mber next to your chosen reply. For example,......1. not at all.

Do you think environmental problems in clearcut forests are veremphasised by the media and conservation organisations?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

Do you think the coupe size used in your logging area is the ost satisfactory for the forests being logged?

1. unsatisfactory
2. not very satisfactory
3. somewhat satisfactory
4. very satisfactory
5. don't know

Is this the most efficient for the logging industry?

Yes 1 No 2

Do you think there is a general misunderstanding by the publi of the long term effects of clearcutting?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

Do you think there has been an improvement in standards o operations in the last ten years?

1. not at all
2. not much
3. somewhat
4. a lot
5. don't know

Do you think the environmental lobby is partly responsible fo these improvements?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

Do you think the Forests Department's environmental guidelines

:e worthwhile?

1. not at all
2. not very
3. somewhat
4. very worthwhile
5. don't know

Do you think the present fire protection methods are adequate?

1. not at all
2. not very
3. somewhat
4. very
5. don't know

Do you think the public believe the immediate effects of logging

.ast forever?

1. not at all
2. not much
3. somewhat
4. a lot
5. don't know

The following questions ask for your personal view about each issue. These questions deal with possible environmental effects from clearcutting native forest. Please answer in the same way as before.

1. What do you think about long term changes to forest scenery following clearcutting operations as carried out in your Region?

1. no change
2. more attractive
3. less attractive
4. don't know

2. Do you think these forests will regenerate with the same timber species as now?

1. fewer species
2. much the same
3. more species
4. don't know

3. Do you think heavy machinery compacts the soil in the forest (excluding the log dumps)?

1. not at all
2. not much
3. somewhat
4. a lot
5. don't know

Where heavy machinery does compact the soil (excluding the log dumps), do you think regeneration is prevented from developing vigorously?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

4. Do you think there were many native animals such as kangaroos, wallabies and other small animals in these forests before clearcutting?

1. not many
2. many
3. very many
4. don't know

5. **Do you think there has been a change in the number of animals iin forests recently clearcut?**

1. a lot more
2. slightly more
3. no change
4. slightly less
5. a lot less
6. don't know

Do you think the clearcutting operations will affect the survival of some animal species?

1. none at all affected
2. not many affected
3. many will be affected
4. don't know

6. **Do you think these forests were used for bushwalking, camping, fishing and other recreation activities before the present clearcutting operatons began?**

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

7. **Do you think the forestry operations have increased the use of the forests by the public?**

1. no change in use
2. small increase in use
3. moderate increase in use
4. large increase in use
5. don't know

8. **In your opinion,**

Do you think there is an increase in the soil erosion occurring in the forest following clearcutting operations?

1. no increase
2. small increase
3. moderate increase
4. large increase
5. don't know

Where an increase in erosion does occur, do you think loss of topsoil seriously affects the regrowth of the forest?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

9. Sometimes soil eroding from forest areas enters local streams. Do you think this affects the use of those streams for drinking, fishing or swimming?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

10. **Do you think the regenerated forest after clearcutting will provide a possible harvest of much the same volume in say 40 to 50 years?**

1. big increase in volume
2. small increase in volume
2. no change
3. small decrease
4. big decrease
5. don't know

The following questions ask what could be done about environmental effects from clearcutting, and some general comments on the forestry industry. Please answer in the same way as before by circling your answer.

11. **Do you think log quotas can be increased and operations still carried out to meet environmental guidelines?**

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

12. **Do you think the costs of meeting environmental guidelines and standards are justified?**

1. not at all
2. not very
3. somewhat
4. very much
5. don't know

13. **Is it important to separate logging coupes to maintain attractive forest scenery in native forests?**

1. not at all important
2. not very important
3. somewhat important
4. very important
5. don't know

14. **Can logging machines be operated so as to reduce the effects of logging?**

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

15. **Do you think drainage requirements for snig tracks and log dumps are adequate?**

1. requirements not sufficient
2. requirements adequate
3. requirements excessive
4. don't know

16. Do you think the Forests Department's regulations are reasonable?

1. not at all
2. not very
3. somewhat
4. very
5. don't know

17. Do you think Forestry Officers spend enough time in the forest?

1. not at all
2. not much
3. somewhat
4. a lot
5. don't know

18. Do you think the enforcement of regulations is fair?

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

19. **Do you think large trees with hollows should be left uncut for animals?**

1. none should be left
2. only those not suitable for sawlogs
3. only those not suitable for sawlog or pulpwood
4. all should be left
5. don't know

20. **Do you think enough wildlife areas are left in the State forests?**

1. too few
2. about right
3. too many
4. don't know

21. **Do different types of logging machine have different effects on the soil (eg. in amount of compaction)?**

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

22. **Is there adequate supervision of inexperienced machine operators?**

1. a lot more supervision would be an advantage
2. some more supervision would be an advantage
3. supervision is ok now
4. don't know

23. **Do you think there is sufficient contact between forestry supervisors and harvesting operators?**

1. not enough
2. about right
3. too much
4. don't know

24. **Did you receive any training in the use of your equipment?**

1. no training
2. some training in use of equipment
3. extensive training

25. **Do you think enough forest is reserved in your Region as National Parks?**

1. too little
2. about right
3. too much
4. don't know

26. **Do you think present harvesting standards and environmental controls benefit the forestry industry?**

1. not at all
2. not much
3. somewhat
4. very much
5. don't know

Any other comments?

Thankyou.

APPENDIX B

FOREST WORKERS' QUESTIONNAIRE

TABLE C.1

Raw score item means for attitude scales

ATTITUDE SCALE	SCALE ITEM MEAN (RAW SCORE)	SD
Cognitive		
AMBIA	0.53	0.07
HYDROL	0.505	0.09
ECOL	0.35	0.08
NUTRIN	0.33	0.06
Affective		
ECOEFF	2.58	0.17
HYDEFF	2.43	0.31
LANDSC	2.33	0.19
Conative		
HYDSTR	3.27	0.40
LNDSTR	3.18	0.83
PSTSTR	2.88	0.25
REGSTR	2.92	0.44
WLDSTR	3.70	0.03
SILSTR	2.94	0.19

Note: These scores are used in the conversion of factor scale means to raw score item means.

Item Mean of factor scale for group = factor scale mean x raw score S.D. + raw score item mean

BOX'S TEST FOR EQUALITY OF DISPERSION MATRICES

This test is described in Cooley and Lohnes (1971) and in Box (1949).

The Lambda test of the null hypothesis of the equality of the mean vectors assumes that the g group dispersion matrices are based on samples of g multivariate normal populations with the same disperson, 'Δ'.

A test criterion for H_1, of the equality of g group dispersion matrices is the null hypothesis that the dispersion matrices are equal.

This test was used to examine whether the 'clearcutting' and 'non-clearcutting' foresters were responding as a single population, or separate populations in the way they grouped items within each of the three dimensions of attitude. This test was necessary to ensure the validity of a factor analysis applied to all foresters to derive factor scales, basic to the analyses of this thesis.

p	=	number of tests
g	=	number of groups
N	=	total number of subjects all groups
n_1	=	degrees of freedom numerator
n_2	=	degrees of freedom denominator
N_1	=	number group 1
N_2	=	number group 2

D_1 = determinant dispersion matrix group 1
D_2 = determinant dispersion matrix group 2
D = determinant dispersion matrix all groups
D_k = dispersion estimate for kth sample
D_w = pooled groups estimate

$$F^{n_1}_{n_2} = \frac{n_2 M}{n_1(b-M)}$$

$$M = (N-g)\ \log_e \left|D_w\right| - \sum_{K=1}^{g} (N_k-1) \log_e \left|D_k\right|$$

$$H_1: \quad \Delta_k = \Delta\ ; \quad k = 1,\ 2 \ldots g$$

for cognitive scales $M = -\ 56.64$
for conative scales $M = 139.205$
for affective scales $M = 988.594$

To calculate appropriate degrees of freedom the parameters A_1 and A_2 are needed. These relate to the following:

$$A_1 = \left(\sum_{k=1}^{g} \frac{1}{N_k - 1} - \frac{1}{N-g} \right) \frac{2p^2 + 3p - 1}{6(g-1)(p+1)}$$

$$A_2 = \left(\sum_{k=1}^{g} \frac{1}{(N_k-1)^2} - \frac{1}{(N-g)^2} \right) \frac{(p-1)(p+g)}{6(g-1)}$$

$A_1 = 0.023$; $A_2 = -\ 0.001065$
$A_1^2 = 0.00529$

$A_2 - A_1^2 = -0.001594$, and is negative,
$\therefore$ degrees of freedom parameters to use are:

$$n_1 = \frac{(q - 1)\ p\ (p + 1)}{2}$$

$$n_2 = \frac{n_1 + 2}{A_1^2 - A_2} \qquad b = \frac{n_2}{1 - A_1 + (2/n_2)}$$

$n_1 = 501.5$

$n_2 = 315872$

$b = 323305.99$

Cognitive dispersion matrices

$$F = -0.110 \quad : \quad F(\overset{n_1}{502};\overset{n_2}{315872}) = F(\infty\ ;\infty) = 1.0$$

F is not significant. It is reasonable to assume that the dispersions in the two populations of 'clearcutting' and 'non-clearcutting' foresters represented by these two samples are equal.

Affective dispersion matrices

$F = 1.93$: F is significant, but the actual difference in the content dimensions between the 'clearcutting' and 'non-clearcutting' States is very minor, and it was considered there was sufficient similarity to warrant a total sample factor analysis.

Conative dispersion matrices

$F = 0.2710$; $F(\infty\ ;\infty) = 1.0$.

F is not significant. It is reasonable to assume that the dispersions in the two populations of 'clearcutting' and 'non-clearcutting' foresters represented by these two samples are equal.

This analysis indicates that both 'clearcutting' and 'non-clearcutting' foresters group the same items into the different content dimensions. It does not indicate whether they have differences in their level of agreement with items.

DETAILS OF FACTOR ANALYSIS

THE COGNITIVE FACTORS

The results of a factor analysis of the responses to the set of items within the cognitive dimension are given in Table E.1. All these items refer to the probability of postulated environmental effects from clearcutting. The responses of foresters to these items represent Fishbein and Ajzen's 'subjective probabilities'. The numbers shown under the columns labelled 'factors' represent the correlations between the items on the questionnaire in the cognitive set (items 1-17), and the four rotated factors. For each item, these numbers also represent the regression coefficients relating each item to all of the other factors. Thus, each item X_i can be described by the regression:

$$X_i = a_{11}F_1 + a_{12}F_2 \cdots + A_{ip}F_p$$

where $a_{11} \ldots a_{ip}$ are the coefficients representing the correlation of variable X_i with factor F_p. For example, item 7 can be described by the regresssion:

$$\text{Item 7} = .45F_1 + .09F_2 + .19F_3 + .12F_4$$

An item was assigned to the factor on which it had the highest correlation, and thus the closest relationship.

Table E.1 shows the correlations between each item and its 'assigned' factor are larger than the correlations between the same item and the other factors. For example, item 13 (erosion on stable soils) has a correlation of .77 on its assigned factor, but only .15, .14 and .05 on the other factors.

Thus, each factor contains the items with the highest correlations on that factor. A correlation or factor loading was not considered acceptable below 0.30 for inclusion in a factor, following the usual inclusion criteria (Nunnally, 1967). The correlations for items in each factor are underlined in Table E.1.[1]

An item may be correlated with more than one factor at 0.30 or above, and indeed item 12 (sedimentation in forest streams) is an example in Table E.1. This item is related to factors 1 and 2. If an item is correlated significantly with more than one factor, it has a 'factorial complexity' greater than one. Where this occurs it is indicated in the table.

Four attitude indices can be obtained from the factors derived in this analysis. These attitude indices correspond to factor scale scores which are derived from the items assigned to each factor. For example, factor 2 was labelled HYDROL, and a factor score, and hence attitude index for this scale, would be found from the equation:

1 Numbers shown in Table E.1 under 'factors' are factor loadings (correlation coefficients x 10^2)

TABLE E.1

Results of Factor Analysis for Items in the Cognitive Dimension

ITEMS	FACTORS 1	2	3	4	FACTORIAL COMPLEXITY	ESTIMATED COMMUNALITY ($x10^2$)
AMBIA						
reduction in recreation settings	<u>49</u>	16	11	12	1	29
effects on panoramic landscapes	<u>44</u>	14	6	20	1	27
effects on micro landscapes	<u>53</u>	18	-2	14	1	34
effects on canopy dwellers	<u>50</u>	13	29	12	1	36
effects on animal diversity	<u>47</u>	10	18	5	1	26
effects on canopy birds	<u>59</u>	21	30	2	1	48
effects on native species	<u>45</u>	9	19	12	1	26
HYDROL						
likelihood of flooding	25	<u>46</u>	7	23	1	33
sedimentation in forest streams	33	<u>57</u>	12	23	2	50
erosion on stable soils	15	<u>77</u>	14	5	1	64
erosion on unstable soils	18	<u>73</u>	18	17	1	62

TABLE E.1 (contd.)

ITEMS	FACTORS 1	2	3	4	FACTORIAL COMPLEXITY	ESTIMATED COMMUNALITY ($x10^2$)
ECOL						
effects on plant diversity	25	10	<u>66</u>	16	1	54
increase in disease susceptibility	19	22	<u>41</u>	32	2	36
long term species changes	22	19	<u>56</u>	21	1	44
NUTRIN						
loss of nutrients	22	23	15	<u>68</u>	1	59
pests before regeneration established	10	27	28	<u>68</u>	1	28
replacement of nutrients	14	9	19	<u>54</u>	1	35

Note: The 'estimated communality' expresses the proportion of the variance of an item that is extracted by all n factors.

$$h_k^2 = \sum_{j=1}^{n} S_{kj}^2$$: the square of the correlation of item k with factor j are summed to give h^2

It is also an estimate of the reliability of each item variable (Nunnally, 1967).

$$\text{HYDROL} = fsc_{1i}z_1 + fsc_{2i}z_2 + \ldots + fsc_{ni}z_n$$

where

fsc_{ni} = the factor score coefficient for variable n, factor i

z_n = standardised score for variable n for each respondent

Factor score coefficients are not shown in Table E.1 but are derived from further manipulation of the factor matrix (Nie et al, 1981).

These factor scores are linear transformations of the original variables, and may be treated like any other quantitative variable. They were used as attitude indices for all dimensions of attitude for the present purposes, and formed the basis to the analyses of Chapter 6 to 10. Culhane (1981) similarly used factor scales as a measure of attitudes in public land politics issues.

The items most highly correlated on a particular factor are also most highly correlated to other items in the factor and not to the items in the other factors. The general dimension relating these items to each other can be labelled according to the nature of the items within a factor. In this analysis, there are four factors, and hence four 'content dimensions' underlying the items in the cognitive dimension of attitude towards clearcutting.

Thus, the four 'content dimensions' identified by this factor analysis were labelled according to the major content of the items represented in each factor. These dimensions are (1) effects of clearcutting on landscapes, wildlife and recreation opportunities (AMBIA); (2) effects on water and water quality (HYDROL); (3) effects on ecological changes, especially loss of nutrients (NUTRIN); and (4) effects on ecological stability related to diversity of species (ECOL). These abbreviations are used throughout the thesis.

The first factor accounts for most variance, and shows foresters see an association between items dealing with effects on wildlife, landscape and recreation. A general term to cover all these issues is not obvious, but this combination of dimensions is related to how people perceive the forest environment (Hawkins, 1981). These dimensions were thus given the term 'ambiance' (AMBIA) to reflect this perceived association. These are, however, merely labels, and carry no assumptions of any other relationship.

No item in this analysis was excluded from a factor scale, although there was an item with a factorial complexity greater than one. For instance, item 12 had a factorial complexity of a two, with 0.33 on factor one, and 0.57 on factor two. The importance of factor two in explaining the variance in this variable is, however, three times that of factor one (0.57^2 or 32 percent for factor 2, 0.33^2 or 10 percent for factor 1).

Factor scores are in standardised units and may be positive or negative, indicating how far a particular score is above or below the mean. Thus, a negative factor score for any of the dimensions indicates a tendency for the responses to items to be generally towards the categories at the lowest end of the response scale, i.e. the respondents disagree that the postulated effects of clearcutting are probable.

THE 'AFFECTIVE' FACTORS

The results of a factor analysis of the affect items (related to the seriousness of postulated effects) is shown in Table E.2. Three factors emerged in this analysis and were rotated to produce three 'content dimensions' among the 'affective' dimension items. Examination of the items loading most highly on each factor showed the general content dimensions were (1) ecological changes (ECOEFF); (2) hydrology and nutrient loss (HYDEFF); and (3) landscape and recreation effects (LANDSC).

Five items show a factorial complexity of two, and a decision had to made about which factor these items were to be placed in. The item 'nutrient removal' has a correlation of 0.42 (16 percent variance) on factor 1 and 0.50 (25 percent variance) on factor 2. This item was included in factor 2 because three of the other items in this factor scale relate to the same content dimension of soil loss and loss of nutrients.

Three items in factor 1 have a factorial complexity of two. The 'plant and animal diversity' item has correlations of 0.65 (37 percent variance) on factor 1 and 0.32 (10 percent variance) on factor 2; 'ecological stability' has correlations of 0.60 (36 percent variance) on factor 1 and 0.37 (14 percent variance) on factor 2; 'short term animal diversity' has correlations of 0.47 (17 percent variance) on factor 1 and 0.33 (11 percent variance) on factor 3. These all have lower loadings on the second significant factor and less than half the variance of the most significant factor, so these items were retained on the first factor.[1]

The item 'effects on recreation opportunities' has approximately equal correlations on two factors, one and three. This item has some content relevant to wildlife and some to landscape. As the main emphasis in the content of factor 1 is ecological effects (the second significant common factor), the item was placed with the landscape content items factor 3 where it is also more logically related.

The three content dimensions of the 'affect' items also represent 'attitude' according to Fishbein and Ajzen's definition.

1 The numbers in Table E.2 under 'factors' represent factor loading (correlation coefficients x 10^2).

TABLE E.2

Results of Factor Analysis for Items in Affective Dimension

ITEMS	FACTORS 1	2	3	FACTORIAL COMPLEXITY	ESTIMATED COMMUNALITY ($\times 10^2$)
LANDSC					
effects on panoramic landscapes	13	19	<u>71</u>	1	56
effects on micro landscapes	11	4	<u>73</u>	1	54
effects on recreation opportunities	41	22	<u>41</u>	2	38
ECOEFF					
plant and animal diversity	<u>65</u>	32	19	2	56
long term community changes	<u>66</u>	26	15	1	52
ecological stability	<u>60</u>	37	10	2	51
short term animal diversity	<u>47</u>	19	33	2	31
long term animal diversity	<u>77</u>	27	15	1	70
long term animal population changes	<u>80</u>	25	12	1	72
long term habitat reduction	<u>65</u>	23	22	1	53
site nutrient capital reduction	<u>46</u>	30	3	1	35
HYDEFF					
nutrient removal	42	<u>50</u>	6	2	43
soil movement within coupes	20	<u>64</u>	13	1	46
flooding in forest streams	20	<u>64</u>	13	1	47
sedimentation in forest streams	29	<u>66</u>	16	1	55
pest and disease outbreaks	27	<u>40</u>	11	1	25

As this is an indication of the extent of 'feeling' or 'emotion' associated with something, these factor scales are also part of a broader dimension of 'emotionalism'.

The factor scores represent the direction of 'attitude' expressed by responses to items. Low or negative scores indicate disagreement with the statements and a low level of agreement that the postulated effects are serious, and are defined as a favourable attitude, and high positive scores as an unfavourable attitude.

THE CONATIVE FACTORS

Results of factor analysis for these items are shown in Table E.3. Six initial factors emerged in this analysis with eigenvalues of one or greater, which were then rotated with the varimax procedure. The content dimensions evident in these factors were (1) hydrology and water quality (HYDSTR); (2) landscape maintenance (LNDSTR); (3) pest and disease reduction (PSTSTR); (4) regeneration (REGSTR); (5) wildlife planning (WLDSTR); and (6) silvicultural alternatives (SILSTR).

One item on the questionnaire, the 'location of cutting coupes', had no significant factor loadings with any factor and was thus excluded from any factor scale. It does not appear in Table E.3.

Three items had significant loadings on two factors. The item 'care near streams' has correlations of 0.50 (25 percent variance) on factor 1 and 0.38 (14

TABLE E.3

Results of Factor Analysis for Items in Conative Dimension

ITEMS	FACTORS Correlations and regression coefficients ($X10^2$)						FACTORIAL COMPLEXITY	ESTIMATED COMMUNALITY ($X10^2$)
	1	2	3	4	5	6		
HYDSTR								
care near streams	<u>50</u>	13	2	38	6	12	2	43
water sampling	<u>55</u>	9	30	10	24	11	2	49
supervision/regulation of heavy machinery	<u>59</u>	12	1	26	10	23	1	49
monitor aquatic life	<u>47</u>	14	21	16	45	7	2	52
LNDSTR								
reduce visual impacts	6	<u>76</u>	-1.7	12	16	8	1	63
avoid logging within viewing limits	26	<u>47</u>	10	2	1	23	1	35
identify and map sensitive landscapes	11	<u>55</u>	-1	25	22	3	1	43
PSTSTR								
need to check regeneration regularly	4	1	<u>72</u>	18	10	21	1	60
need to check young regrowth	19	3	<u>75</u>	6	8	17	1	63

TABLE E.3 (contd.)

ITEMS	FACTORS Correlations and regression coefficients ($X10^2$)						FACTORIAL COMPLEXITY	ESTIMATED COMMUNALITY ($X10^2$)
	1	2	3	4	5	6		
REGSTR								
need for extra planting	13	7	20	<u>37</u>	12	14	1	23
need to survey regeneration	10	14	16	<u>48</u>	25	-7	1	36
need for greater supervision	25	10	12	<u>53</u>	7	11	1	39
need for varying filter strip width	8	10	-5	<u>43</u>	11	23	1	39
WLDSTR								
need for animal survey	21	21	18	18	<u>63</u>	10	1	56
need for specific planning	10	18	-0.6	23	<u>64</u>	28	1	58
SILSTR								
use of mechanical disturbance	0.4	1	16	4	6	<u>45</u>	1	23
selection logging	24	12	18	17	1	<u>38</u>	1	28
use of small coupes where appropriate	25	11	6	14	16	<u>52</u>	1	27
habitat trees	29	23	10	7	13	<u>40</u>	1	33

percent variance) on factor 4; 'water sampling' has correlations of 0.55 (27 percent variance) on factor 1 and 0.30 (9 percent variance) on factor 3; and 'monitor aquatic life' has correlations of 0.47 (28 percent variance) on factor 1 and 0.45 (20 percent variance) on factor 5.

The item 'monitor aquatic life' has similar loadings on factor 1 (Hydrology) and factor 5 (wildlife planning). These are both relevant dimensions on which this item could be placed, but the factor with the highest loading was used.

A comparison of the defined 'content dimensions' (Table 2.3) used in developing the items for the questionnaire and the empirical 'content dimensions' defined by the factor analysis of the 'conative' item set is shown in Table E.4.

TABLE E.4

A comparison of 'defined' and 'empirical' content dimensions in 'conative' items

Defined dimensions	Empirical factor dimensions
HYDROLOGY	HYDROLOGY
WILDLIFE	WILDLIFE
PESTS AND DISEASE	PESTS AND DISEASE
LANDSCAPE	LANDSCAPE
RECREATION	UNSTABLE (not in any factor)
ECOLOGICAL EFFECTS	REGENERATION
	SILVICULTURE

The content dimensions for this set of items also represent a broader dimension, that of 'Conservatism-radicalism'. Low factor scores represent disagreement with the proposed environmental protection proposals, and suggest protection is adequate.

In other words, there is no need to change current practice, a conservative response. Low scores are at the conservative end of this dimension; high scores are at the more radical end, where significant changes are proposed from current practice.

SUMMARY

The factor scales obtained from these three analyses of item sets represent the attitude indices for the three separate components of attitude. The cognitive dimension of attitude having four indices, the affective dimension three, and the conative dimension six.

CONVERGENT AND DISCRIMINANT VALIDITY

The correlation matrix for the three components of attitude with the appropriate sets of factor scales, produces the three matrices shown in Table F.1. The convergent validity hypothesis is that different scales within the set of scales for each attitude component measure the same component, that is, correlations between the scales within each set are significantly different from zero.

In Table F.1, all these correlations are significantly different from zero at $p < .01$. The validity hypothesis is thus supported and the scales within each set measure the same component of attitude.

The discriminant validity hypothesis is that the scales used to measure one component do not measure other components, that is, correlations among the scales measuring each component are higher than the correlations between scales measuring different components.

Three different comparisons were made to test this hypothesis. The first is between the cognitive scales and correlations with the affective and conative scales, shown in Table F.2. The second comparison is between the affective scales and correlations with the cognitive and conative scales, shown in Table F.3. The third comparison is between the conative factor scales and the cognitive and affective scales, shown in Table F.4.

The comparisons show that the correlations among factor scales on each attitude component are higher than correlations between the scales for different components for all three attitude components. This confirms the discriminant validity of the scales used, and shows that reliably different responses were made to the three classes of attitude statements.

TABLE F.1

Correlations among factor scales:
A test of convergent validity

Attitude Component	Scale	Scale					
		AMBIA	HYDROL	ECOL	NUTRIN		
Cognitive	AMBIA	1.0					
	HYDROL	0.46	1.0				
	ECOL	0.48	0.38	1.0			
	NUTRIN	0.40	0.42	0.44	1.0		
		ECOEFF	HYDEFF	LANDSC			
Affective	ECOEFF	1.0					
	HYDEFF	0.69	1.0				
	LANDSC	0.39	0.32	1.0			
		HYDSTR	LNDSTR	SILSTR	WLDSTR	PSTSTR	REGSTR
Conative	HYDSTR	1.0					
	LNDSTR	0.35	1.0				
	SILSTR	0.46	0.30	1.0			
	WLDSTR	0.48	0.39	0.40	1.00		
	PSTSTR	0.35	0.11	0.36	0.25	1.0	
	REGSTR	0.49	0.32	0.34	0.42	0.29	1.00

TABLE F.2

Correlations between factor scales:
A test of discriminant validity
cognitive scales compared with affective and conative

Component	Scale	Scale			
		AMBIA	HYDROL	ECOL	NUTRIN
	AMBIA	X	0.46	0.48	0.40
Cognitive	HYDROL	0.46	X	0.38	0.42
	ECOL	0.48	0.38	X	0.44
	NUTRIN	0.40	0.42	0.44	X
Mean correlation		0.45	0.42	0.43	0.42
	ECOEFF	0.50	0.39	0.45	0.50
Affective	HYDEFF	0.41	0.52	0.42	0.53
	LANDSC	0.44	0.22	0.27	0.30
Mean correlation		0.45	0.38	0.38	0.44
	HYDSTR	0.32	0.35	0.30	0.36
	LNDSTR	0.26	0.15	0.15	0.14
	SILSTR	0.40	0.38	0.38	0.46
Conative	WLDSTR	0.28	0.22	0.20	0.28
	PSTSTR	0.11	0.18	0.21	0.20
	REGSTR	0.23	0.26	0.22	0.19
Mean correlation		0.27	0.26	0.24	0.27

proportion of between correlations < among = 31/36. (max. among)

TABLE F.3

Correlations between factor scales:
a test of discriminant validity,
affective scales compared with cognitive and conative scales

Component	Scale	ECOEFF	HYDEFF	LANDSC
Affective	ECOEFF	X	0.69	0.39
	HYDEFF	0.69	X	0.32
	LANDSC	0.39	0.32	X
Mean correlation		0.54	0.50	0.36
Cognitive	AMBIA	0.50	0.41	0.44
	HYDROL	0.39	0.52	0.22
	ECOL	0.45	0.42	0.27
	NUTRIN	0.50	0.53	0.30
Mean correlation		0.36	0.47	0.23
Conative	HYDSTR	0.41	0.46	0.30
	LNDSTR	0.20	0.15	0.35
	SILSTR	0.44	0.42	0.30
	WLDSTR	0.39	0.30	0.26
	PSTSTR	0.19	0.23	0.07
	REGSTR	0.22	0.24	0.18
Mean correlation		0.31	0.30	0.24

Proportion between correlation $<$ among = 29/30 (max among)

TABLE F.4

Correlations between factor scales:
a test of discriminant validity,
conative scales compared with cognitive and affective

Component	Scale	Scale					
		HYDSTR	LNDSTR	SILSTR	WLDSTR	PSTSTR	REGSTR
	HYDSTR	X	0.35	0.46	0.48	0.35	0.49
Conative	LNDSTR	0.35	X	0.30	0.39	0.11	0.32
	SILSTR	0.46	0.30	X	.40	0.36	0.34
	WLDSTR	0.48	0.39	0.40	X	0.25	0.42
	PSTSTR	0.35	0.11	0.36	0.25	X	0.29
	REGSTR	0.49	0.32	0.34	0.42	0.29	X
Mean correlation		0.43	0.23	0.37	0.38	0.27	0.37
	AMBIA	0.32	0.26	0.40	0.28	0.11	0.23
Cognitive	HYDROL	0.35	0.15	0.38	0.22	0.18	0.26
	ECOL	0.30	0.15	0.38	0.20	0.21	0.22
	NUTRIN	0.36	0.14	0.46	0.28	0.20	0.19
Mean correlation		0.33	0.17	0.40	0.24	0.18	0.22
	ECOEFF	0.41	0.20	0.44	0.39	0.19	0.22
Affective	HYDEFF	0.46	0.15	0.42	0.30	0.23	0.24
	LANDSC	0.30	0.35	0.30	0.26	0.07	0.18
Mean correlation		0.39	0.23	0.39	0.32	0.16	0.21

proportion between correlations < among = 41/42 (max among)

APPENDIX G

DEPARTMENT OF FORESTRY (Queensland)
MINISTER
CONSERVATOR
DEPUTY CONSERVATOR

DIVISION OF PLANNING	DIVISION OF OPERATIONS	DIVISION OF MARKETING	DIVISION OF TECHNICAL SERVICES	DIVISION OF ADMINIS- TRATION
.general planning	.silviculture	.harvesting & marketing	.forest research	.accounts
.economics	.general operations	.resources	.timber utilization	.general adminis- tration
.organizational services				.ADP
				.special administration

source: Queensland Department of Forestry Annual Report

TABLE H.1

The distribution of foresters'

Nominated activities

Number of activities	percent of foresters
0	1.0
1	76.8
2	12.4
3	5.0
4	4.8

Activities nominated	percent of foresters
listed items only	73.4
other only	26.6
one of listed items	50.2
two of listed items	6.6
three of listed items	4.3
four of listed items	4.4
one listed plus other	5.8
two listed plus other	0.7
three listed plus other	0.4

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RESPONSE TO EXAMINERS' COMMENTS

Chapter 7

1. The discussion on pages 128-129 implies clearcutting may be unsound ecologically and appears to ignore the problems faced by foresters in the forest situation.

- The discussion suggests that attitudes can be influential in decision-making and that foresters need to be aware that attitudes can affect judgements. The thesis sought a neutral stand on the issue of clearcutting per se. The effect of environmental factors is emphasised in Chapter 3 and the model proposed.

Chapter 8

1. The R^2 values in Table 8.9 are not discussed.

- There is a brief note under Table 8.9 and comments on page 193 bearing on reasons for such low values.

2. The effect of management experience may be capturing the effect of age and of changing norms within different age cohorts (eg. students).

- Management experience of clearcutting is more important in the context of attitudes towards clearcutting than age per se. The discussion on pages 148-149 also emphasises the importance of length of experience.

- Differences in the attitudes of age cohorts could not be tested and is probable. The discussion on pages 156-157 presents a possibility but needs further research.

Chapter 10

1. The propositions on pages 204/206 appear to be speculative and beyond the data.

- The views presented here suggest some institutional factors that might influence policy-makers, and why they may be faced with complex situations demanding organizationally oriented attitudes, apart from the effects indicated by the thesis.

Chapter 12

1. It is not clear why attitude-activity and group attitudes do not adequately explain gradation in attitudes.

- The need for a theoretical framework beyond the social psychological and group attitude approaches is discussed in Chapter 3. This thesis in fact combines social psychological, group attitudes and an ecological perspective in order to grasp the complexity of attitude variation among foresters.

2. Data show managerial and production foresters are very similar, weakening the distinction between these groups in the gradient.

- This similarity is discussed on pages 182-186. It is possible that the allocation of activities to functional groups needs modification, to separate these two groups more effectively.

Chapter 13

1. There appears to be a shift in the analysis from individual attitudes to organizational behaviour.

- Although individual attitudes were sought, the focus of this study is on group attitudes (see page 56) which were the basis of analyses, and were then applied to organizational behaviour in Chapter 13 as suggested on page 269.

- An additional variable indicating employer might have been useful.

2. It is questionable whether interest groups' views are valid to suggest organizational maladaptability in relation to clearcutting.

- These views suggest activities which others might perceive as maladaptive, and may or may not be founded in fact. These comments need to be read in this light.

3. There is an implication that policy-makers should not aim to meet organizational objectives (page 283).

- The discussion emphasises the link between attitudes and behaviour (decision-making). It may be that organizational objectives need amending, but it is also necessary that there is a diversity in the attitudes of policy-makers, so that different means of meeting these objectives might be considered.